

PHILIPS

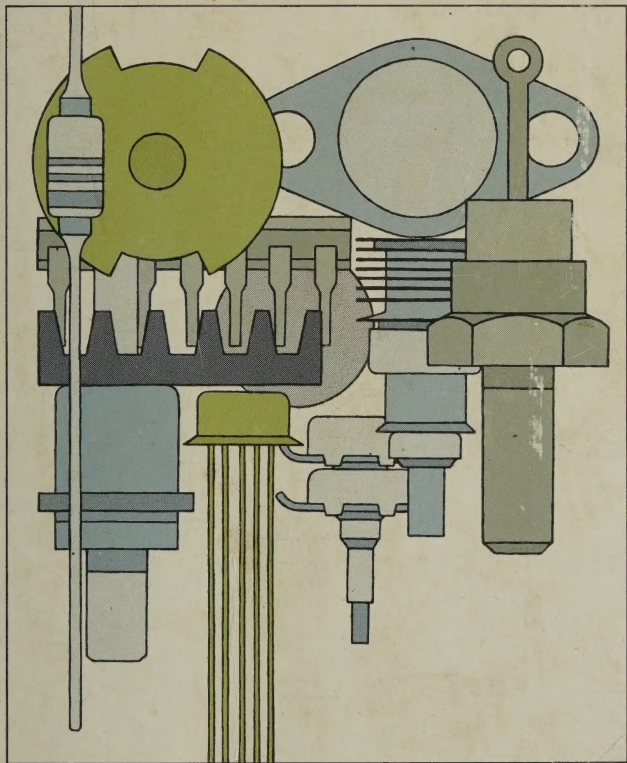


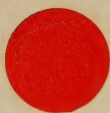
Electronic
components
and materials

1972

Pocketbook

electron tubes
semiconductors
integrated circuits
components and materials

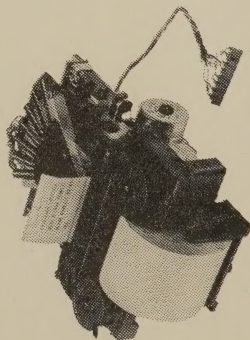




PERIPHERAL DEVICES

Mosaic printers 60SA, catalogue number 4311 111 03370 Application: These devices can print all characters that can be formed within a 5 × 7 dot matrix (with 5 columns of 7 dots each) on a standard paper roll of 60 mm width. The 60SR, equipped with an inked-ribbon (cat. No. 2811 062 06001) system, prints on ordinary paper (cat. No. 2811 063 10001), the 60SA is designed for printing on 3M's self-action paper (cat. No. 2811 063 10051).

60SR, catalogue number 4311 111 03380



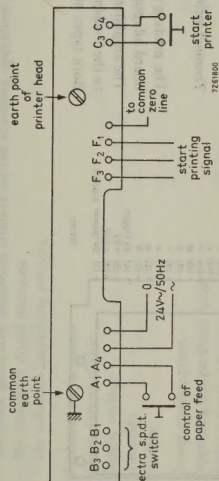
The printers are controlled by a module CM20, containing the circuits for character generation and printer head drive.

Technical performance:

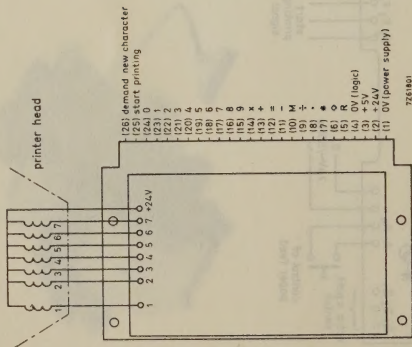
Character spacing	min. 3 columns, min. 0.7 mm
Line spacing	approx. 5 mm
Character width × height	max. 1.8 × 2.5 mm
Printing speed	50 characters per second
Line speed	60 lines of max. 20 characters per min.
Column capacity	adjustable between approx 18 and 20
Data entry	serial entry
Temperature range	
operating	0 to +55°C
storage	-25 to +55°C
Power supply	
- Printer head, voltage } current }	see CM20
- Motors, voltage }	24 V ± 10%, 50 Hz
current of	
printer head motor	200 mA
paper transport motor	60 mA
inked-ribbon transport motors (type 60SR only)	90 mA per motor
Width × depth × height	148 × 210 × 76 mm
mounting	6 holes of 3.7 mm (for screw-tapping screws of 4 mm), 1 hole of 3.5 mm.

Electrical connections

The printer head is equipped with a 9-wires flexible cable of which 8-wires are to be connected to the character module and 1 wire to the earth point on the rear panel of the printer. The 8-wire connection is pluggable at the character module. To the rear of the frame-work a small p.w. board is mounted. The pluggable connections are shown below.



20-Character module CM20, catalogue number 4311 111 02490



Terminal location

The module is provided with 26 contacts on the diode matrices printed-wiring board adapted to a single sided printed-wiring connector type FO45.

The amplifier printed-wiring board has 8 terminals, of which 7 are to be connected to the 7 solenoids on the printer head and one supplies the common 24 V.

Both types of Mosaic Printer are supplied with an 8-pole plug for the purpose.

Application: The 20-character module has been designed to control a mosaic printer type 60SA or 60SR. It selects and drives the various solenoids of the printer head in order to print the character selected at the character inputs.
 Character input selection and character printing is performed serially. The logic voltage levels for all input and output terminals are adapted to the commonly used DTL and TTL integrated circuits.

The module consists of three major parts:

- the clock generator, decoding circuits for the scanning operation and start circuit.
- the character diode matrices.
- the solenoid amplifying circuits.

Technical performance

Characters available

Supply voltage

solenoids

module

Power consumption

Operating temperature range

Width \times depth \times height

mounting

{ numerals 0 to 9
 symbols - · + \times \div * \diamond R M

21.6 to 26.4 V, max. 28 V

4.75 to 5.25 V, max. 7.0 V

21 W

0 to 55°C

148 \times 90 \times 64 mm

4 holes of 3.2 mm

Logic levels

Character inputs. A character is selected when its input is at high level; all other inputs must be at low level.

Input HIGH V min. 2.4 V

Input LOW V max. 0.8 V

Start input. The electronic module is started when the start signal is at low level.

Input HIGH V min. 2 V

Input LOW V max. 0.6 V

Demand New Character output. When the signal "demand new character" is present this output is at low level.

Output HIGH V min. 2.4 V

- I max. 0.4 mA

V max. 0.4 V

I max. 16 mA

10 TTL gate loads

Fan-out

MEMORY PRODUCTS

Ferroxcube memory cores

core size (mil)	core type	nominal operating conditions					relevant typical output characteristics					
		T (°C)	I (mA)	C4 ¹⁾ (mA/degC)	DR	t _r (μs)	t _d (μs)	μV _i (mV)	rV _i (mV)	wV _z (mV)	t _p (μs)	t _s (μs)
30	6F3	70	740	1.3	0.50	0.15	0.6	60	58	5	0.25	0.50
30	6F8	40	655	3.7	0.50	0.1	0.5	55	53	6	0.20	0.39
20	6H2	25	963	1.4	0.50	0.05	0.26	50	49	4	0.110	0.215
20	6H3	25	890	3.6	0.50	0.05	0.24	49	48	4	0.100	0.200
20	6H4	25	710	2.7	0.50	0.05	0.27	66	63	5	0.115	0.225
20	6H5	60	800	1.7	0.50	0.05	0.25	72	69	7.5	0.105	0.195
20	6H9	25	800	2.0	0.50	0.05	0.25	64	61	8.5	0.110	0.210
18	6H6	60	778	1.3	0.50	0.05	0.20	59	57	5	0.095	0.175
14	6V2	25	855	1.9	0.50	0.03	0.16	41	40	4	0.070	0.130

¹⁾ Rate of change of full drive current for constant μV_i

Note: Offers for cores differing from those of our range may be made on request.

Matrix planes and stacks

SYSTEMS We can supply matrix planes and stacks for the three following memory systems:

(A) 2D-systems (word organised memories)

(B) 3D-systems (bit organised memories)

(C) 2½D-systems

Matrix planes are available in frame construction, on a printed-wiring board and in a construction suitable for mounting on a printed-wiring board (Platrics).

A number of types have been standardised on core pattern, wiring, types of core and construction.

Matrix planes with 50 mil cores

Catalog number, for ordering: 2722 043 (for suffix see Table)

core pattern preferred	wiring X Y Z S	core type	unlacquered		lacquered	
			left	right	left	right
			suffix	suffix	suffix	suffix
64 × 64	1 1 1 1	6C1	06001	06081	06011	06091
		6D5	06021	06101	06031	06111
		6C2	06041	06121	06051	06131
		6D9	06061	06141	06071	06151
4 × 16 × 16	1 1 4 4	6C1		25001		25011
		6D5		25021		25031
		6C2		25041		25051
		6D9		25061		25071
4 × 32 × 32	1 1 4 4	6C1		26001		26011
		6D5		26021		26031
		6C2		26041		26051
		6D9		26061		26071
4 × 64 × 64	1 1 4 4	6C1		27001		27011
		6D5		27021		27031
		6C2		27041		27051
		6D9		27061		27071

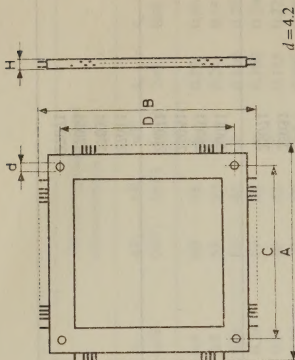
MEMORY PRODUCTS

Dimensions in mm

The dimensions A to D refer to Figs. 1 and 2.

core pattern	A	B	C	D
64 × 64	120	120	100.2	100.2
4 × 16 × 16	85	85	64.5	64.5
4 × 32 × 32	125	125	105.2	105.2
4 × 64 × 64	208	208	186.7	186.7

$d = 3.2$
 $H = 4.8$



$d = 4.2$
 $H = 4.8$

Matrix planes with 20 mil cores
Catalog number, for ordering 2722 045 (for suffix see Table)

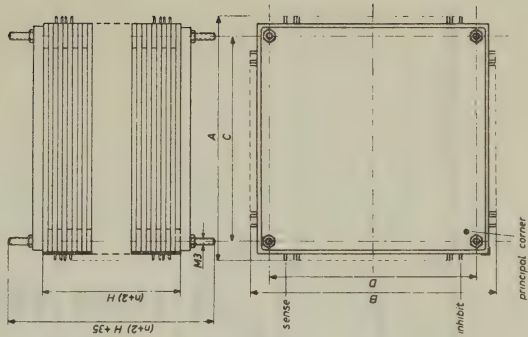
core pattern preferred	wiring			core type	lacquered		dimensions in mm Figs 1 and 2	
	X	Y	Z S		left suffix	right suffix	A × B	C × D
128 × 128	1	1	4 4	6H3	08021	08031	120 × 120	100.1 × 100.1
	1	1	4 4	6H2	08041	08051		
	1	1	8 4	6H3	08061	08071		
	1	1	8 4	6H2	08081	08091		
2 × 64 × 128	1	1	4 4	6H3	35021	35031	119.3 × 120	99.5 × 100.1
	1	1	4 4	6H2	35041	35051		
	1	1	8 4	6H3	35061	35071		
	1	1	8 4	6H2	35081	35091		

4 × 64 × 64	1	1	4	4 ¹⁾	6H3	27021	27041	119.3 × 119.3	99.5 × 99.5
	1	1	4	4 ¹⁾	6H2	27031	27051	119.3 × 119.3	99.5 × 99.5
	1	1	8	8	6H3	27061	27071	122 × 122	102.1 × 102.1
	1	1	8	8	6H2	27081	27091	122 × 122	102.1 × 102.1

¹⁾ Matrices without interlaced sense wiring.

Stacks

Fig. 2. Dimensions in mm
n = number of planes
Dimensions A to D : see Tables



Platirices with 50 mil cores, for direct mounting on printed wiring boards

Standard range

Preferred types (paper-base laminate frame, 6 C2 cores)

core pattern	catalog number		outer dimensions over the tags (mm)
	for 2.54 mm grid	for 2.50 mm grid	
16 × 16	2722 051 02051	2722 051 02041	82 × 82
16 × 32	2722 051 10051	2722 051 10041	82 × 122
32 × 32	2722 051 05051	2722 051 05041	122 × 122
4 × (4 × 16)	2722 051 28051	2722 051 28041	82 × 82
4 × 8 × 8	2722 051 22051	2722 051 22041	82 × 82
4 × 8 × 16	2722 051 29051	2722 051 29041	82 × 122
4 × 12 × 12	2722 051 24051	2722 051 24041	102 × 102
4 × 16 × 16	2722 051 25051	2722 051 25041	122 × 122
2 × 16 × 32	2722 051 20051	2722 051 20041	122 × 122

MEMORY PRODUCTS

3D core matrices on printed wiring boards

Core matrices for the 3D system mounted and lacquered on the copper-clad surface at both sides of a glass-epoxy board. Special attention has been paid to heat transfer.

Versions with 30 mil cores

Cycle time 2 μ s. Core pitch 30 mil Dimensions 89 \times 89 or 140 \times 140 mm, thickness 1.6 mm

Spacing in stacks 3.2 mm

Standard range :

core pattern	wiring X Y Z S			core type	main dimensions	catalog number 2722 061
2 \times (4 \times 32 \times 32)	1	1	4	4	6F8 6F3	26011 26001
2 \times (2 \times 32 \times 64)	1	1	2	2	6F8 6F3	21011 21001
2 \times (64 \times 64)	1	1	1	1	6F8 6F3	06011 06001
2 \times (4 \times 64 \times 64)	1	1	4	4	6F8 6F3	27011 27001
	1	1	8	4	6F8 6F3	27031 27021
2 \times (2 \times 64 \times 128) ¹⁾	1	1	4	4	6F8 6F3	35011 35001
	1	1	8	4	6F8 6F3	35031 35021

$2 \times (128 \times 128)$ ¹⁾	1	1	4	4	6F8	140×140	08011
	1	1	4	4	6F3		08001
	1	1	8	4	6F8		08031
	1	1	8	4	6F3		08021

Versions with 20 mil cores

Cycle time 1 μ s. Core pitch 20 mil Dimensions $115 \times 115 \times 1.6$ mm

Spacing in stacks 3.2 mm

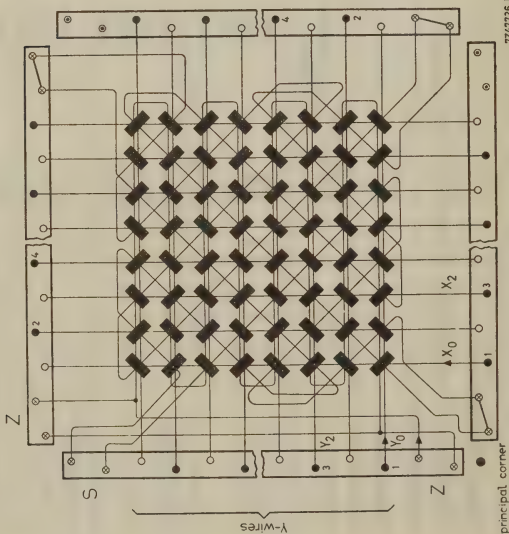
Standard range:

core pattern	wiring				core type	catalog number
	X	Y	Z	S		
$2 \times (4 \times 64 \times 64)$	1	1	4	4 ²⁾	6H2	27001
	1	1	4	4 ²⁾	6H3	27011
	1	1	4	8	6H2	27021
	1	1	4	8	6H3	27031
$2 \times (2 \times 64 \times 128)$	1	1	4	4	6H2	35001
	1	1	4	4	6H3	35011
	1	1	4	8	6H2	35021
	1	1	4	8	6H3	35031
$2 \times (128 \times 128)$	1	1	4	4	6H2	08001
	1	1	4	4	6H3	08011
	1	1	4	8	6H2	08021
	1	1	4	8	6H3	08031

¹⁾ Matrices with interlaced sense wiring

²⁾ Matrices without interlaced sense wiring.

X-wires

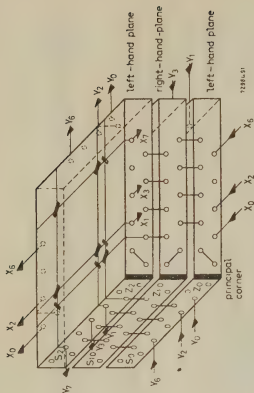


Wiring diagram of a matrix plane (50 mil)

Left-hand plane

- lower lugs
- upper lugs
- ⊗ S and Z lugs

arrows show current flow in write direction



Principle of the connections to a stack having an odd number of single-matrix planes (50 mil)

Magnetic core memories

memory type	standard capacity range		standard operating modes	standard timing		standard operating environment	power-supplies required
	words	bits		access max.	full cycle		
FI-2 and multiples	1 024	8	Random access	0.6 μ s	4 μ s	0–55°C	+12 V, 3 A
			Read-restore				
			Read-write				
			Clear-write				
FI-3 and multiples			Split-cycle				
	1 024	max. 18	Random access	1 μ s	3 μ s	0–50°C	+6 V, 6.4 A
	2 048	max. 18	Read-restore		(half cycle 2 μ s)		–12 V, 4.3 A
	4 096	max. 18	Clear-write				
	8 192	max. 18	Read-only				
FI-4			Write only				
			Split-cycle				
	4 096	max. 40	Random access	0.39 μ s	1 μ s	0–50°C	115 V/220 V
	8 192	max. 20	Read-restore				50–60 Hz
FI-11			Clear-write				
			Read-write				
			Split-cycle				
	256	4	Random access	1 μ s	6 μ s	0–55°C	+5 V, 0.95 A
FI-14			Read-write				–6 V, 0.5 A
			Read-only				+12 V, 0.8 A
			Write only				
FI-14			Random access	1 μ s	2 μ s	10–55°C	+5 V, 1 A
			Read-only				+12 V, 0.9 A
			Write only				–6 V, 0.4 A

MEMORY PRODUCTS

memory type	standard capacity range		standard operating modes	standard timing		standard operating environment	power-supplies required
	words	bits		access max.	full cycle		
FI-21	1024	8	Random access Read-restore Clear-write Read-write Read only Write only	0.4 μ s	1.6 μ s	0-55°C	+5 V, 3.5 A -5 V, 4.5 A
FI-23	80 160	17 17	Random access Read-restore Clear-write	2 μ s	8 μ s	0-50°C	+5 V, 3 A max. -5 V, 0.6 A max.
FI-41	4096 8 192 12 288 16 384	18 18 18 18	Random access Read-restore Clear-write Read-mod. write Read only Write only	0.4 μ s	1 μ s	0-55°C	+5 V, 1.5 A +12 V, 1.0 A +24 V, 4.0 A
FI-41F	4096	16	Random access Read restore Clear-write	0.4 μ s	1.2 μ s	0-55°C	+24 V, 3.8 + 0.6 nA ¹⁾ +12 V, 0.75 nA ¹⁾ +5 V, 0.5 + 1.5 nA ¹⁾ -5 V, 0.15 nA ¹⁾
FI-42	4096	8	Random access Read-mod. write clear write	0.35 μ s	1.6 μ s	0-50°C	+5 V, 0.9 A +18 V, 3.6 A -18 V, 0.9 A

FI-43	4096	18	Random access Read-mod. write Read cycle	0.5 μ s 1.8 μ s	0-50°C	+5 V, 1.2 A +15 V, 2.2 A -12 V, 0.2 A
32P06	8192 16384 24576 32768	18 18 18 18	Random access Read-write Clear-write Split-cycle	$\leq 0.28 \mu$ s $\leq 0.64 \mu$ s	0-45°C	-5 V, 16.5 A +12 V, 1.4 A -12 V, 4.5 A +15 V, 7.2 A -15 V, 7.2 A
500G2	524288 262144 131072	9 18 36	Random access Read-restore Read-mod. write Clear-write Split-cycle	$\leq 1.2 \mu$ s $\leq 2.5 \mu$ s	10-40°C	-6 V, 6 A +6 V, 9.5 A +12 V, 7.5 A +30 V, 2.5 A +10-21 V, 0.05 A +48 V, 7 A

¹⁾ n = number of 4 k modules

MEMORY PRODUCTS

memory type	approximate size	signal characteristics	
		input	output
FI-2	Height 121.8 mm	"0" = 0-0.4 V	"0" = 0-0.4 V
	Depth 205 mm	"1" = 2.2-6.5 V	"1" = 3.6-4.4 V
	Width 82 mm		
FI-3	Height 135 mm	"0" = 0-0.4 V	"0" = 0-0.4 V
	Depth 325 mm	"1" = 2.8-6.5 V	"1" = 3.5-6.5 V
	Width 485 mm (including power supply)		
FI-4	Height 134 mm	"0" = 0-0.4 V (20 mA)	"0" = 0-0.4 V (20 mA)
	Depth 268 mm	"1" = 2.4-5.5 V (0 mA)	"1" = 2.4-5.5 V (0.5 mA)
	Width 485 mm		
FI-11	Height 160 mm + 11.5 mm	"0" = 0-0.6 V	"0" = 0-0.6 V
	Depth 150 mm	"1" = 2.2-5.5 V	"1" = 2.2-5.5 V
	Width 20.3 mm		
FI-14	Height 192 mm	"0" = 0-0.6 V	"0" = 0-0.6 V
	Depth 165 mm	"1" = 2.2-5.5 V	"1" = 2.2-5.5 V
	Width 51 mm		
FI-21	Height 122 mm	"0" = 0-0.6 V	"0" = 0-0.4 V
	Depth 212 mm	"1" = 2.2-5.5 V	"1" = 2.5-12 V
	Width 83 mm		

FI-23	Height 204 mm Depth 165 mm Width 50 mm	"0" = 0-0.5 V "1" = 2.8-6.5 V	"0" = 0-0.5 V "1" = 2.8-6.5 V
FI-41	Height 255 mm Depth 330 mm Width 63.5 mm	"0" = 0-0.5 V "1" = 2.5-5.25 V	"0" = 0-0.5 V "1" = 2.8-5.25 V
FI-41F	Height 208 mm Depth 310 mm Width 60 mm	"0" = 0-0.4 V "1" = 2.4-5.5 V	"0" = 0-0.4 V "1" = 2.4-5.5 V
FI-42	Height 233.4 mm Depth 160 mm Width 80 mm	"0" = 0-0.8 V "1" = 2-5.5 V	"0" = 0-0.4 V "1" = 2.4-5.5 V
FI-43	Height 355.8 mm Depth 307 mm Width 25.6 mm	"0" = 0-0.5 V "1" = +2.5-5 V	"0" = 0-0.5 V "1" = 2.5-5 V
32P06	Height 444 mm Depth 400 mm Width 472 mm	"0" = 0-0.5 V "1" = 2.85-3.15 V	"0" = 0-0.5 V "1" = 2.85-8 V
500G2	Height 1498 mm Depth 508 mm Width 457 mm	"0" = 2.3-6.6 V "1" = -1-1.2 V	"0" = perm. sinh current 150 mA with V_{ce} at 0.3 V "1" = 0-0.5 V

MEMORY PRODUCTS

Glass delay line modules

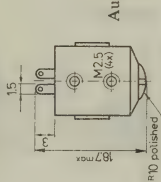
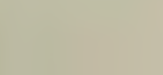
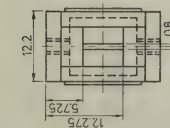
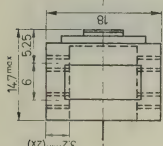
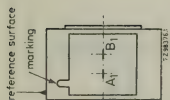
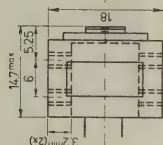
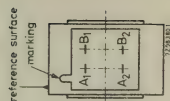
<i>type</i>	<i>capacity</i>	<i>data rate</i>	<i>delay</i>	<i>operating temperature</i>	<i>power supplies required</i>
GDM11 (master)	256 bits	0.5 MHz	512 μ s	0–55°C	5 V at 150 mA
GDM11 (master)	256 bits	4 MHz	64 μ s	0–55°C	5 V at 150 mA
GDM12 (slave)	256 bits	as set by master	as set by master	0–55°C	5 V at 100 mA

<i>type</i>	<i>approx. size</i>	<i>signal characteristics</i>		<i>features</i> (GDM11 and GDM21 only)
		<i>input</i>	<i>output</i>	
GDM11	Length 150 mm	"0" = 0–0.8 V (1.6 mA)	"0" = 0–0.4 V (16 mA)	Modules can be paralleled if larger capacities are needed Built-in crystal-controlled clock will drive up to seven slaves
GDM21	Height 30 mm	"1" = 2.0–5.5 V (1 mA)	"1" = 2.4–5.0 V (0.4 mA)	
GDM12	Width 52 mm			

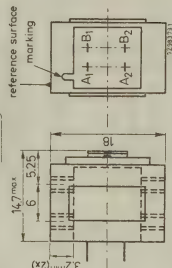
MAGNETIC HEADS

Audio heads (studio)

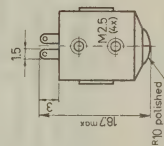
type	tape width (inch)	number of tracks	track width (mm)	gap length (μ m)	inductance (mH)	catalog number
erase	$\frac{1}{4}$	1	6.55	2×100	1.7	2722 131 00021
erase	$\frac{1}{4}$	2	2.5	2×100	1.7	2722 131 00031
record	$\frac{1}{4}$	1	6.55	7	7	2722 132 01071
reproduce	$\frac{1}{4}$	1	6.55	4	75	2722 132 02101
record	$\frac{1}{4}$	2	2.35	7	7	2722 132 01081
reproduce	$\frac{1}{4}$	2	2.35	4	75	2722 132 02111
record (stereo)	$\frac{1}{4}$	2	2.90	7	7	2722 132 01091
reproduce (stereo)	$\frac{1}{4}$	2	2.90	4	75	2722 132 02121



Audio heads 2722 131 00031
2722 132 01081
2722 132 02111



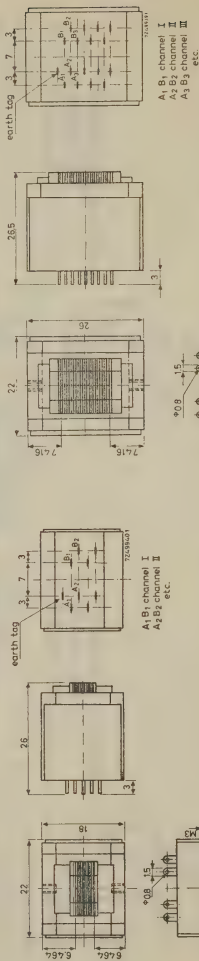
Audio heads 2722 132 01091
2722 132 02121



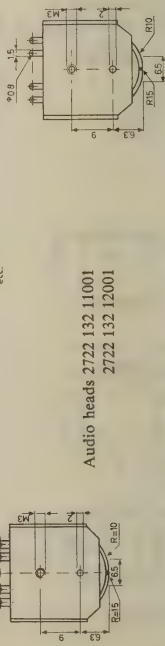
MAGNETIC HEADS

Audio heads (voice filing)

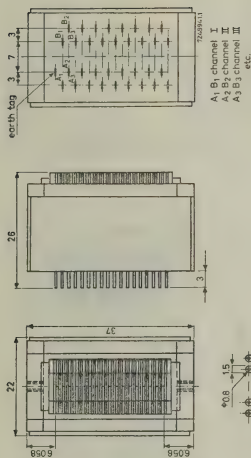
type	tape width (inch)	number of tracks	track width (mm)	number of tracks on tape, interlaced use	gap length (μ m)	inductance (mH)	catalog number
record	$\frac{1}{4}$	4	0.5	7	6-7	6	2722 132 11001
reproduce	$\frac{1}{4}$	4	0.5	7	3-4	53	2722 132 12001
record	$\frac{1}{2}$	8	0.5	15	6-7	6	2722 132 11011
reproduce	$\frac{1}{2}$	8	0.5	15	3-4	53	2722 132 12011
record	1	17	0.5	31	6-7	6	2722 132 11021
reproduce	1	17	0.5	31	3-4	53	2722 132 12021



Audio heads 2722 132 11001
2722 132 12001



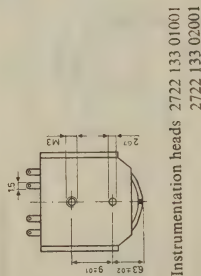
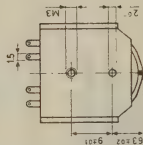
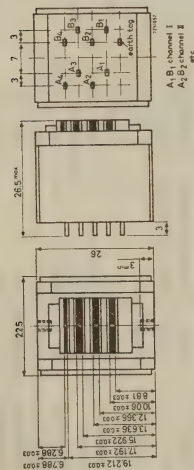
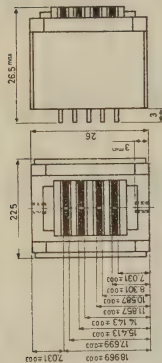
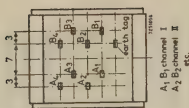
Audio heads 2722 132 11011
2722 132 12011



Audio heads 2722 132 11021
2722 132 12021

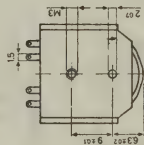
Instrumentation heads

type	tape width (inch)	number of tracks (data + annotation)	track width (mm)		number of tracks on tape, interlaced use (data + annotation)	gap length (μm)	inductance (mH)	catalog number
			data	annotation				
record	$\frac{1}{2}$	3+1	1.27	0.5	7+1	3-4	0.1	2722 133 01001
record	$\frac{1}{2}$	4	1.27		7+1	3-4	0.1	2722 133 01011
reproduce	$\frac{1}{2}$	3+1	1.27	0.5	7+1	1.5-2.5	2.0	2722 133 02001
reproduce	$\frac{1}{2}$	4	1.27		7+1	1.5-2.5	2.0	2722 133 02011
record	1	7+1	1.27	0.5	14+2	3-4	0.1	2722 133 01021
reproduce	1	7+1	1.27	0.5	14+2	1.5-2.5	2.0	2722 133 02021

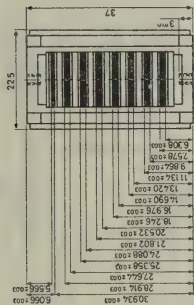
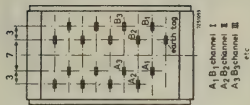


Instrumentation heads 2722 133 01011
2722 133 02011

Instrumentation heads 2722 133 01001
2722 133 02001



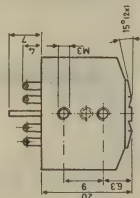
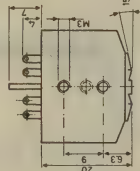
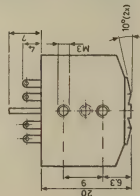
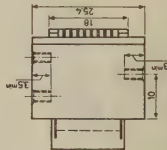
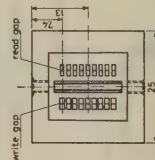
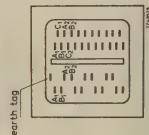
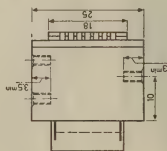
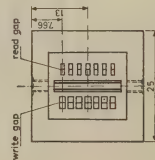
Instrumentation heads 2722 133 01021
2722 133 02021



MAGNETIC HEADS

Digital (tape) heads

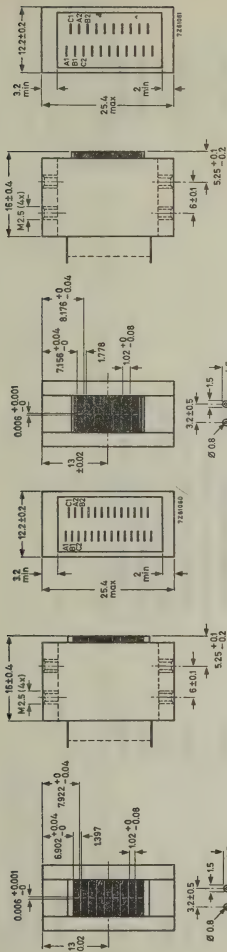
type	tape width (inch)	number of tracks	track width (mm) write read	gap length (μm) write read	inductance (μH) write read	catalog number
write/read	$\frac{1}{2}$	7 } dual 7 } 9 }	1.20	11-13	30	2722 135 03041
write/read	$\frac{1}{2}$		1.20	11-13	125	2722 135 03071
write/read	$\frac{1}{2}$		1.08	11-13	20	2722 135 03091
write/read	$\frac{1}{2}$	9 } single 7 } 9 } 7 }	0.98	6	4000	2722 135 03321
write/read	$\frac{1}{2}$		0.98	6	8000	2722 135 03331
write/read	$\frac{1}{2}$		1.08	12	1450	2722 135 03341
write/read	$\frac{1}{2}$		1.18	12	450	2722 135 03351



Technical drawing of a digital tape head assembly. The top view shows a rectangular head with a width of 25 mm and a height of 13 mm. The side view shows a height of 10 mm and a width of 18 mm. Dimensions are given in mm.

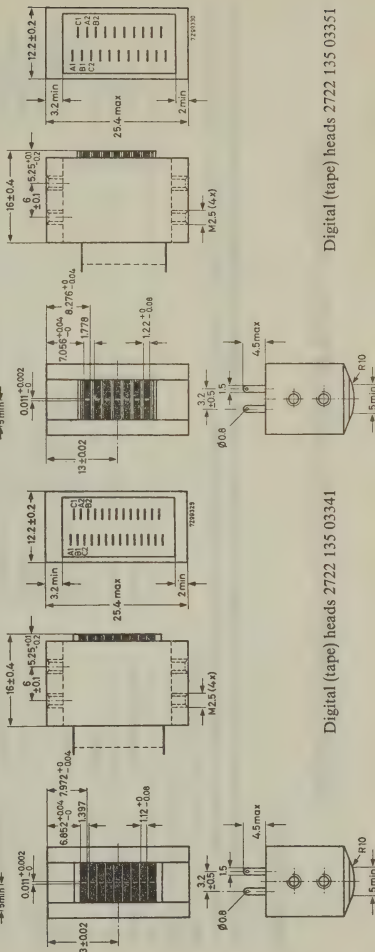
Digital (tape) heads 2722 135 03041
2722 135 03071

Digital (tape) heads 2722 135 03091



Digital (tape) heads 2722 135 03321

Digital (tape) heads 2722 135 03331



Digital (tape) heads 2722 135 03341

Digital (tape) heads 2722 135 03351

QUARTZ CRYSTAL UNITS AND CRYSTAL FILTERS

Quartz crystal units

A quartz crystal unit consists of a quartz crystal element with electrodes, mounted in a glass or metal holder having connecting pins or leads. In a quartz crystal unit the piezoelectric characteristics of quartz have been used to obtain a component that is equivalent to a stable resonance circuit with a very high Q -factor. Types for general frequency stabilisation

crystal cut	frequency range (MHz)	holder	type ref.
AT (fundamental)	1.8-20	metal - HC-6/U, HC-17/U	4322 152
	7-20	metal - HC-18/U, HC-25/U	4322 153
	2.3-20	all-glass - HC-27/U	4322 154
	4.5-20	all-glass - HC-26/U, HC-29/U	4322 155
AT (third overtone)	10-61	metal - HC-6/U, HC-17/U	4322 157
	17-61	metal - HC-18/U, HC-25/U	4322 158
	10-61	all-glass - HC-27/U	4322 159
	10	all-glass - HC-27/U	4322 159 00001
	20-61	all-glass - HC-26/U, HC-29/U	4322 160
AT (fifth overtone)	50-87	metal - HC-6/U, HC-17/U	4322 163
	50-87	metal - HC-18/U, HC-25/U	4322 164
	50-87	all-glass - HC-27/U	4322 165
	50-87	all-glass - HC-26/U, HC-29/U	4322 166

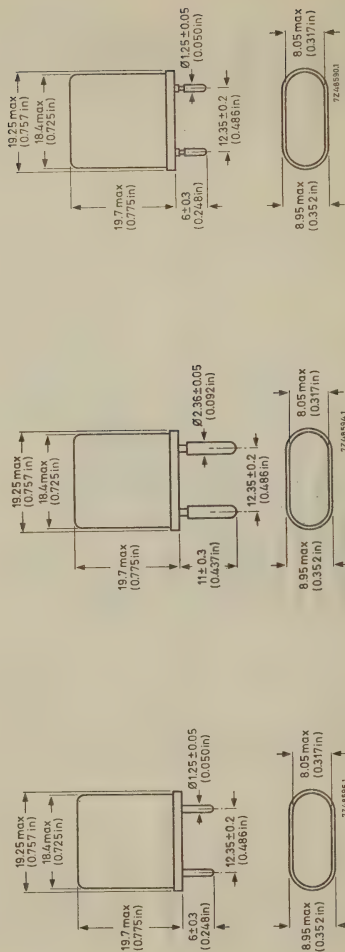
Types for special applications

<i>application</i>	<i>holder</i>	<i>data</i>	<i>crystal cut</i>	<i>for further data see type</i>
steering of models	HC-6/U	27.125 MHz, 0/ + 60°C total tolerance $\pm 1000 \times 10^{-6}$ series resonance 40.68 MHz, 0/ + 60°C total tolerance $\pm 500 \times 10^{-6}$ series resonance 13.56 MHz, 0/ + 60°C total tolerance $\pm 500 \times 10^{-6}$ $C_L = 30$ pF in parallel	AT AT AT	4322 157 00010 4322 157 00020 4322 152 01300
measuring equipment	HC-6/U	1 MHz 4.5 5.5 6.75 10.7 - 20/ + 70°C Total tol. $\pm 100 \times 10^{-6}$ $C_L = 30$ pF in parallel	AT	4322 152 01240 01280 01250 01290 01260

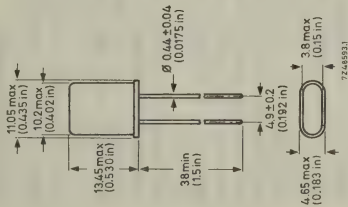
QUARTZ CRYSTAL UNITS AND CRYSTAL FILTERS

Metal and all-glass holders

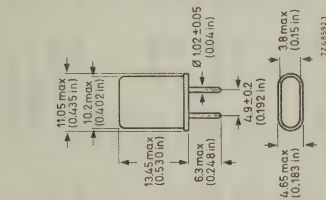
The following holders state the nominal frequency in MHz on the top.
The figures on one of the faces constitute registration numbers that relate to the data and series of manufacture.



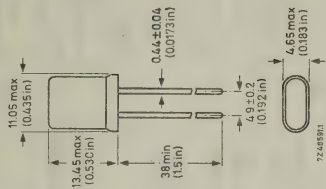
The figures on the other faces constitute registration numbers that relate to the date and series of manufacture.



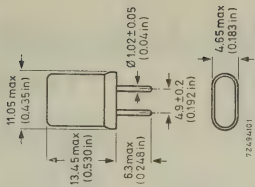
HC-18/U (metal)



HC-25/U (metal)



HC-26/U (glass)



HC-29/U (glass)

QUARTZ CRYSTAL UNITS AND CRYSTAL FILTERS / MICROWAVE DEVICES

Crystal filters

10.7 MHz-90 dB types

channel spacing (kHz)	pass-band width (kHz)	terminating impedances (Ω //pF)	dimen- sions Fig.	type number	catalog number for ordering
± 50	± 15 at 3 dB	2000//25	1	YL3620	9573 136 20000
		2000//25	2	YL3670	9573 136 70000
	910//25	910//25	1	YL3680	9573 136 80000
		910//25	2	YL3690	9573 136 90000

± 25	± 7.5 at 3 dB	910//25	1	YL3622	9573 136 22000
			2	YL3672	9573 136 72000
± 20	± 6 at 3 dB ± 6 at 6 dB	825//25	1	YL3678	9573 136 78000
			2	YL3687	9573 136 87000

± 12.5	± 3.75 at 3 dB	560//25	1	YL3682	9573 136 82000
			2	YL4200	9573 142 00000

11.5 MHz-80/90 dB types

± 50	± 17.5 at 3 dB	2200//20 2700//41	2	YL3619	9573 136 19000
			1	YL3621	9573 136 21000

Dimensions in mm

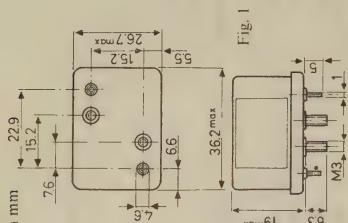


Fig. 1

mm inches

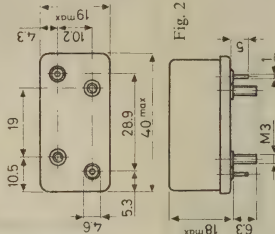


Fig. 2

MICROWAVE DEVICES

Coaxial 3-port circulators

frequency MHz	catalog number	insertion loss < (dB)	isolation > (dB)	V.S.W.R. max.	max. power (W)	dimensions (mm)	
						diameter	height
170-200	2722 162 01191	0.4	20	1.2	500	185 ¹⁾	96
200-230	2722 162 01201	0.4	20	1.2	500	185 ¹⁾	96
370-402	2722 162 01221	0.3	20	1.2	100	80	57
406-470	2722 162 01051	0.6	20	1.2	100	110	71
406-470	2722 162 01151	0.4	20	1.2	100	80	57
445-485	2722 162 01231	0.3	22	1.2	100	80	57
450-550	2722 162 01091	0.6	20	1.2	100	110	71
470-600	2722 162 01061	0.6	20	1.2	100	110	71
470-600	2722 162 01121	0.35	22	1.2	500	110	71
590-720	2722 162 01131	0.35	22	1.2	500	110	71
590-720	2722 162 01071	0.6	20	1.2	100	110	71
590-720	2722 162 01171	0.35	22	1.2	100	80	57
608-783	2722 162 01101	0.75	20	1.2	100	110	71
710-860	2722 162 01081	0.6	20	1.2	100	110	71
710-860	2722 162 01141	0.35	22	1.2	500	110	71
710-860	2722 162 01181	0.35	22	1.2	100	80	57
710-860	2722 162 01241	0.35	22	1.2	100	80	57
3600-4200	2722 162 01111	0.5	25	1.15	50	72	27

All circulators have N-type 50 Ω female connectors. ¹⁾ Triangular shape.

MICROWAVE DEVICES

Waveguide 3-port circulators

frequency GHz	catalog number	insertion loss < (dB)	isolation > (dB)	V.S.W.R. max.	max. power (W)	dimensions (mm) 1)	height	flange type
3.4 -3.7	2722 161 02031	0.3	25	1.1	50	F-C=50	74	C.C.T.U.no.6
3.6 -3.9	02041	0.3	25	1.1	50	F-C=50	55	C.C.T.U.no.6
3.6 -4.2	02001	0.4	25	1.12	100	F-C=58	55	I.E.C.-UER 40
3.6 -4.2	02011	0.3	28	1.1	50	□ 120	82	I.E.C.-UER 40
5.925-6.425	02051	0.3	25	1.12	100	□ 82.5	52	I.E.C.-UER 70
5.925-6.425	02101	0.2	30	1.06	100	□ 83	53	I.E.C.-UER 70
6.425-7.125	02081	0.15	30	1.07	100	□ 83	53	I.E.C.-UER 70
7.125-7.750	02091	0.2	30	1.06	100	□ 83	53	I.E.C.-UER 70
7.7 -8.5	02021	0.3	25	1.1	50	57×65	58	I.E.C.-UER 84 UBR 84

Waveguide 4-port circulators

frequency GHz	catalog number	insertion loss < (dB)	isolation $\alpha_{1-3} > (dB)$	isolation $\alpha_{1-4} > (dB)$	V.S.W.R. max.	max. power (W)	dimensions (mm) □ height	flange type (I.E.C.)
5.925-6.175	2722 161 03081	0.1	33	20	1.05	150	70 57	UER 70
6.125-6.425	2722 161 03091	0.1	30	20	1.06	150	70 57	UER 70
6.575-6.875	2722 161 03031	0.4	25	20	1.1	100	70 57	UER 70
6.825-7.125	2722 161 03011	0.4	25	18	1.08	100	70 57	UER 70
7.125-7.425	2722 161 03001	0.3	25	18	1.1	100	70 57	UER 70
7.425-7.725	2722 161 03041	0.4	30	20	1.1	100	70 53	UER 70
10.700-11.700	2722 161 03061	0.3	30	18	1.1	25	44.5 46	UBR 100
12.500-13.500	2722 161 03051	0.3	25	20	1.1	25	38 45	UER 140 UBR 140

Coaxial isolators

frequency GHz	catalog number	insertion loss < (dB)	isolation > (dB)	V.S.W.R. max.	max. power (W)	dimensions (mm) diameter height
0.740-0.810	2722 162 02001	0.3	22	1.2	100	80 57.5
0.890-0.970	02011	0.3	22	1.2	100	80 57.5
1.48-1.95	02041	0.3	20	1.2	50	65 × 70 ²⁾ 33
2.96-3.22	02021	0.3	20	1.2	100	72 28
3.56-3.90	02031	0.3	20	1.2	100	72 28

¹⁾ F-C=flange to centre. ²⁾ Rectangular shape.

MICROWAVE DEVICES

Waveguide isolators

frequency MHz	catalog number	insertion loss < (dB)	isolation > (dB)	V.S.W.R. max.	max. power (W)	length (mm)	flange type I.E.C.
3.650-3.950	2722 161 01011	0.5	30	1.05	15	140	UER 40
3.800-4.200	2722 161 01081	0.5	30	1.05	10	180	UER 40
3.800-4.200	2722 161 01071	0.8	30	1.05	10	140	UER 48
3.900-4.200	2722 161 01021	0.5	30	1.05	15	140	UER 40
4.200-4.600	2722 161 01091	0.5	30	1.05	10	140	UER 48
4.600-5.000	2722 161 01101	0.8	30	1.05	10	140	UER 48
5.925-6.425	2722 161 01191	0.3	30	1.05	20	115	UER 70
6.425-7.150	2722 161 01251	0.3	30	1.05	20	115	UER 70
6.825-7.425	2722 161 01231	0.3	30	1.05	20	115	UER 70
7.125-7.750	2722 161 01291	0.3	30	1.05	20	115	UER 70
7.125-7.750	2722 161 01281	0.3	30	1.05	20	115	UER 70
7.250-7.750	2722 161 01241	0.3	30	1.05	20	115	UER 70
7.400-8.025	2722 161 01151	0.5	30	1.05	10	115	UER 70
7.700-8.500	2722 161 01161	0.5	30	1.05	10	100	UBR 84
7.700-8.500	2722 161 01051	0.5	30	1.05	10	100	UBR 84
8.500-9.600	2722 161 01211	0.5	30	1.05	10	76.2	UBR 100
8.500-9.600	2722 161 01221	0.6	15	1.15	1	35	UBR 100
8.500-9.600	2722 161 01261	1.2	55	1.20	10	99	UBR 100
8.500-9.600	2722 161 01271	1.0	20	1.15	10	42.5	UBR 100
10.700-11.700	2722 161 01171	0.8	30	1.05	5	80	UBR 100
12.500-13.500	2722 161 01181	0.5	30	1.05	10	60	UBR 140

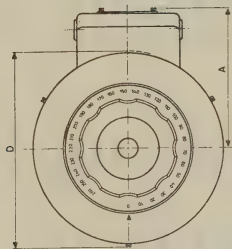
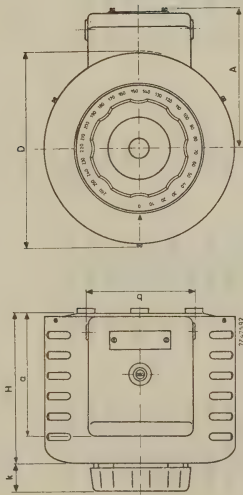
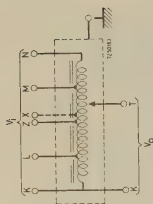
VARIABLE MAINS TRANSFORMERS

1-10 A (conventional types)

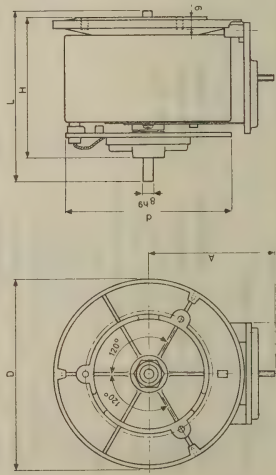
input voltage (V)	output voltage (V)	nom. output current (A)	max. output current for const. Z_{load} (A)	catalog number 2422 530			
				bench model with knob	panel model without knob	laboratory model with terminals	laboratory model with socket
130	0-150	2.5	3.2		02306		
		5	6.3		03306		
		10	12.6		04306		
220	0-220	6.5	7.5		14406		
		10	12		15406		
220	0-260	1	1.4	02401	02406		03405
		2.5	3.2	03401	03406		04405
		5	6.3	04401	04406	04404	05405
		8.5	11.2	05401	05406	05404	05405
240	0-270	1	1.4	02501	02506		
		2.5	3.2	03501	03506		
		5	6.3	04501	04506		
		8.5	11.2	05501	05506		

VARIABLE MAINS TRANSFORMERS

K-L = M-N = 18 % of K-N
 Z = centre tap
 X = optional tap



Main dimensions of bench models and laboratory models



Main dimensions of panel models

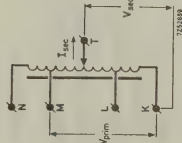
catalog number dimensions (mm)						
2422 530 0	H	D	A	a	b	k
2401 2501	122	113	79	99	77	21
3401 3501	123	134	93	100	77	21
4401 4501	131	166	117	106	92	24
5401 5501	133	193	134	106	92	24

catalog number	dimensions (mm)								
	H	D	A	d	b	L			
2422 530,									
02306	02406	02506	14406	110	106	63	93	71	153
03306	03406	03506	15406	112	127	74	110	71	153
04306	04406	04506		117	158	92	140	84	157
	05406	05506		120	185	106	168	84	157

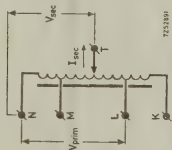
12-15 A (conventional types)

input voltage (V) output voltage (V) nom. output current (A) max. output current for const. Z_{load} (A) catalog number 2422 530 catalog number of knob with dial

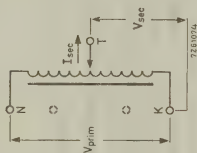
200	0-220	15	18	16407	2922 511 90056
220	0-260	12	15	06407	2922 511 90058
240	0-260	12	15	06507	2922 511 90058



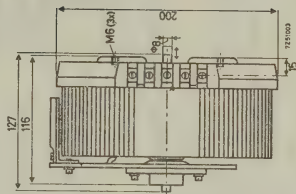
behind panel



on panel



on panel
(type 16407)



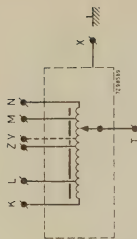
types 06407 and 06507

VARIABLE MAINS TRANSFORMERS

23 A (conventional types)

input voltage (V)	output voltage (V)	nom. output current (A)	max output current for const. Z_{load} (A)	catalog number 2422 530	
				bench model with knob	panel model without knob ¹⁾
220	0-260	23	30	07401	07406
240	0-260	23	30	07501	07506

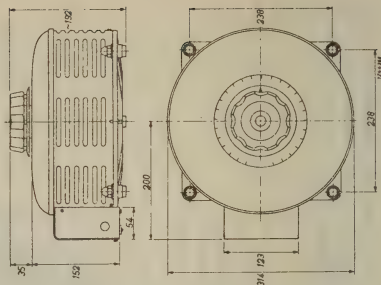
¹⁾ And without feet. A knob is separately available under No. 2922 511 90028, a dial under Cat. No. 4322 026 18560.



K-L = M-N = 18% of K-N

Z = centre tap

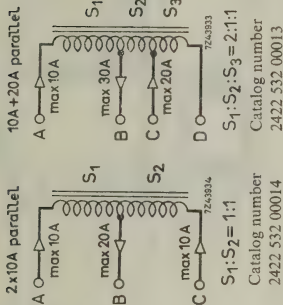
Y = optional tap



Main dimensions of
bench models

Chokes

For parallel mounting of two or three transformers, chokes should be inserted between the secondaries to prevent high interchange currents caused by small differences in the ganging.



Ganging units

For ganging two or three transformers, sets of standard ganging units are available for bench and panel models.

Motor drive modules

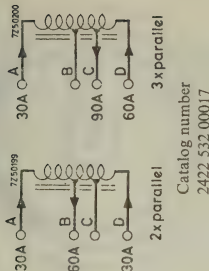
All transformers, either stacked or individual, can be provided with remote controlled motor drives. These motor drives are supplied as kits with easy to assemble loose parts. Two types of synchronous motors together with a series of gear boxes permit a choice out of a large range of speeds.

A.C. stabiliser module BEY 801

This module is capable of stabilising voltages to a value set by means of a control potentiometer.

Accuracy of stabilisation: ± 1 V.

The voltage to be stabilised can vary between -15% and $+10\%$ of the desired value.

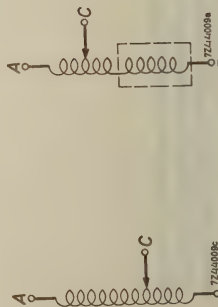
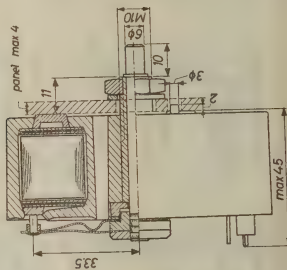


VARIABLE MAINS TRANSFORMERS

Moulded transformers

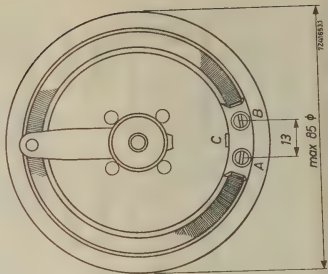
input voltage (V)	output voltage (V)	nom. output current (A)	direction of rotation ¹⁾	output connections	catalog number
60	0-60	1.2	CW CCW	CB CA	2422 530 00007
220	110-220	0.5	CW CCW	CB CA	2422 530 00407
240	120-240		CW CCW	CB CA	

¹⁾ Seen from extending spindle end;
CW = clockwise,
CCW = counter clockwise.

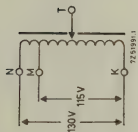


Transformer
2422 530 00007

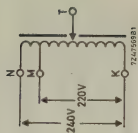
Transformer
2422 530 00407



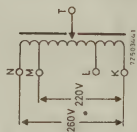
input voltage (V)	output voltage (V)	nom. output current (A)	max. output current for const. Z_{load} (A)	catalog number
70	0-70	5.5	5.5	2422 530 13707
115/130	0-130	1.2	1.4	2422 530 01607
115	0-115	1.4	1.7	2422 530 11607
220	0-220	0.83 1.4 2.5	1.0 1.7 3.0	2422 530 11407 2422 530 18407 2422 530 13407
220/ 240	0-240	0.7	0.83	2422 530 01407
220/ 260	0-260	1.2 2.0	1.4 2.4	2422 530 08407 2422 530 03407
240/ 260	0-260	2.0	2.4	2422 530 03507



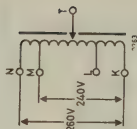
Transformer
2422 530 01607



Transformer
2422 530 01407



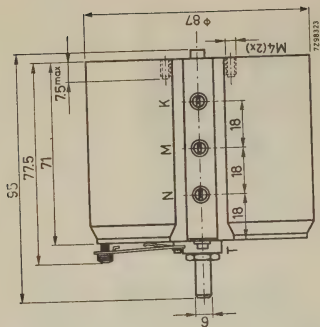
Transformers
2422 530 03407
2422 530 08407



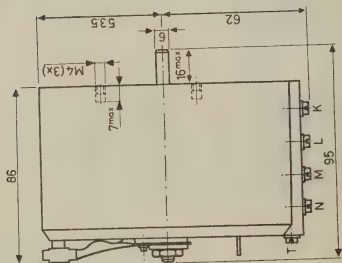
Transformer
2422 530 03507

VARIABLE MAINS TRANSFORMERS

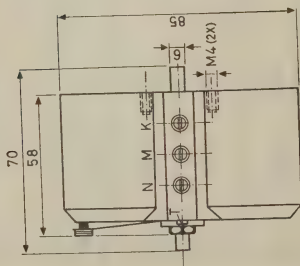
C76



Transformers 2422 530 08407
18407



Transformers 2422 530 03407
2422 530 03507
2422 530 13407
2422 530 13707



Transformers 2422 530 01407
and 2422 530 01607

(Without connecting M for types 2422 530 11407)
2422 530 11607)

Input voltage 220 V
 Output voltage (no load) 248 V
 Nom. output current 3 A

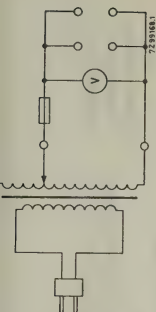


Diagram of bench model 2422 529 00005

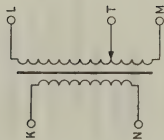


Diagram of panel model 2422 529 00006

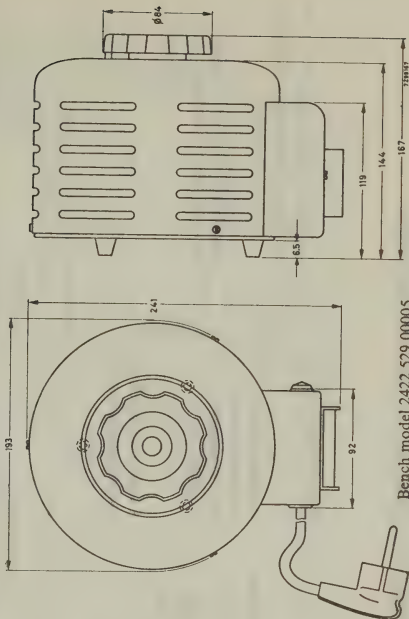
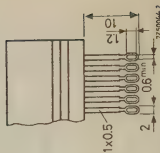
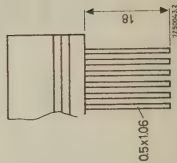
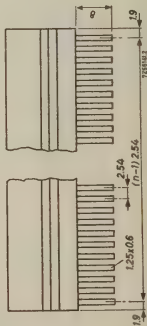
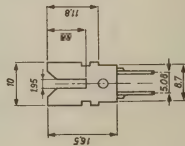


Diagram of bench model 2422 529 00005

ELECTRO-MECHANICAL COMPONENTS

Printed-wiring connectors

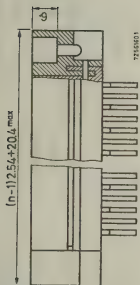
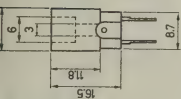
Type number	: F 044	Catalog number: 2422 02	16 = double-sided bridged
Colour	: black		18 = double-sided bridged, minus on contact at either end
Contact pitch	: 0.1" (2.54 mm)	termination code	number of contact positions (n) 06, 07, 08, 09, 10, 11 or up to 39
Number of connections	: 4 to 39 (double-sided bridged)	1 = dipsolder pins	
Max. r.m.s. voltage	: 100 V	2 = wire-wrap pins	
Max. current at $\leq 65^{\circ}\text{C}$	: 4 A	3 = solder tags	
Material of body	: tropic proof phenolic resin	3 = with fixed brackets	
		4 = without brackets	



Connector with dipsolder pins, without brackets

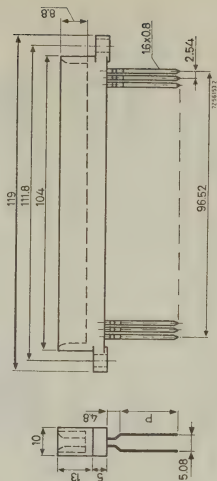
Connector with wire-wrap pins, without brackets

Connector with solder tags, without brackets



Connector with dipsolder pins and fixed brackets

- Type number : F 059
 Colour : black
 Contact pitch : 0.1" (2.54 mm)
 Number of connections : 39 (double-sided bridged)
 Max. r.m.s. voltage : 100 V
 Max. current at $\leq 65^{\circ}\text{C}$: 4 A
 Material of body : tropic proof phenolic resin
 Catalog number : 2422 022 03916, connector
 with wire-wrap pins
 2422 023 03916, connector
 with solder tags

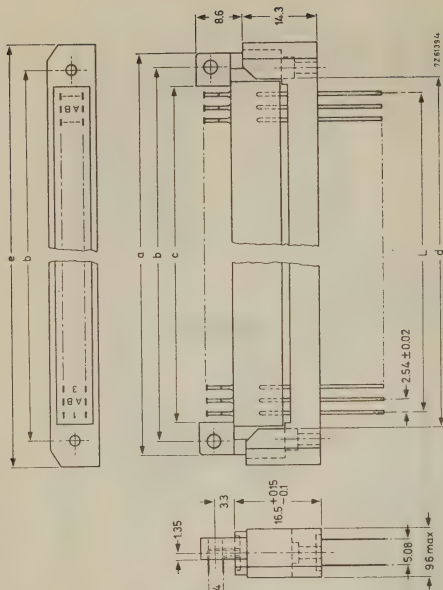


P=19.6mm for wire-wrap terminations
 4.6mm for solder terminations

ELECTRO-MECHANICAL COMPONENTS

Type number: F 054
 Colour: green or blue
 These connectors are composed of a board part and a panel part.
 Contact pitch: 0.1" (2.54 mm)
 Number of connections: 32, 48, 64, 96¹⁾
 Max. r.m.s. voltage: 250 V
 Max. current: 32 A
 Material of body: glass fibre filled diallylphthalate (blue) or glass fibre filled polyester resin (green)
 Contact termination of panel part: solder tags, dipsolder pins, wire wrap pins, dipsolder pins
 of boardpart:

¹⁾ Only with blue diallylphthalate body



number of connections (double sided)	L	a _{max}	b	c _{min}	d	e _{max}
32	38.10	54.5	48.3	41.4	44.0	58.3
48	58.42	68.6	68.6	61.7	64.3	78.6
64	78.74	95.0	88.9	82.0	84.6	98.9
96	119.38	135.7	129.5	122.64	125.2	139.5

Fig. A. Panel part with wire wrap pins

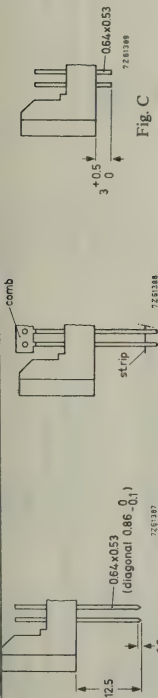


Fig. A

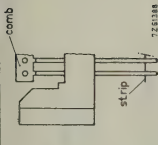


Fig. B

Fig. B. Panel part with wire wrap pins (back panel version).

Fig. C

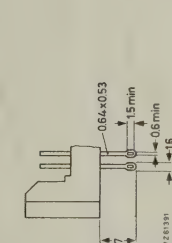


Fig. E

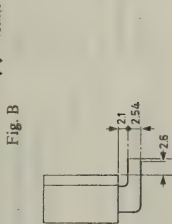


Fig. D

Fig. D. Panel part with hooked dipsolder pins.

Fig. E. Panel part with solder tags.

number of connections	body mat.	catalogue number 2422 025 89...				board part	
		panel part according to				Fig. A	Fig. E
32	diallyphthalate	117	118	119	122	121	114
48		123	124	125	127	126	115
64		128	129	131	133	132	116
96		211	212	213	215	214	209
32	polyester	183	184	185	198	186	182
48		188	189	191	199	192	187
64		194	195	196	201	197	193

ELECTRO-MECHANICAL COMPONENTS

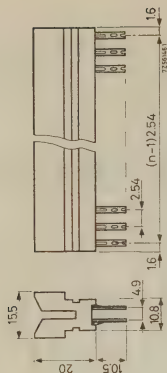
Type number	: F 058
Colour	: black
Contact pitch	: 0.1" (2.54 mm)
Number of connections	: 4 to 45, single-sided
	: 8 to 90, double-sided
Max. r.m.s. voltage	: 100 V
Max. current at $\leq 100^{\circ}\text{C}$	: 5 A
Material of body	: tropic proof phenolic resin
Catalog number	: 2422 023 1 . . .

version, see table

number of positions (n)

06, 07,

08, 09, 10 or up to 45



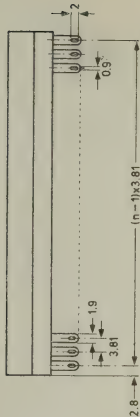
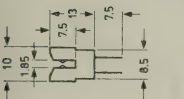
version	number of contact positions containing a contact	version indication
single-sided	all	02
double-sided	all	12
single-sided	all but the two outermost	04
double-sided	all but the two outermost	14

Type number : F 046
 Colour : black
 Contact pitch : 0.15" (3.81 mm)
 Number of connections: 4 to 45, single sided
 8 to 90, double sided
 Max. r.m.s. voltage : 250 V
 Max. current at $\leq 43^{\circ}\text{C}$: 3 A
 Material of body : tropic proof phenolic resin
 Catalog number : 2422 0 . . 6 . . .

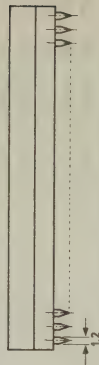
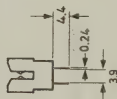
termination code
 36 = solder tags
 42 = dipsolder pins

version
 see table

number of contact
 positions (n) 06, 07, 08,
 09, 10 or up to 45



Connector with solder tags



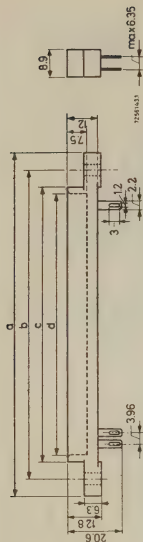
Connector with dipsolder pins

<i>version</i>	<i>number of contact positions containing a spring</i>	<i>version indication</i>	$\geq 0.8 \mu\text{m}$ gold plate on contact face	$\geq 0.2 \mu\text{m}$ gold flash on contact face
single-sided	all	02		42
double-sided	all	12		52
single-sided	all but the two outermost	04		44
double-sided	all but the two outermost	14		54

ELECTRO-MECHANICAL COMPONENTS

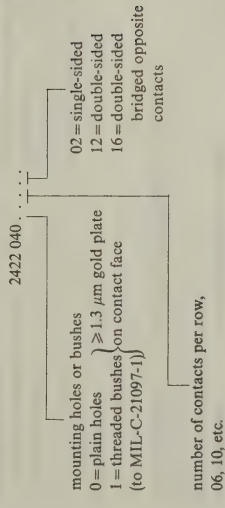
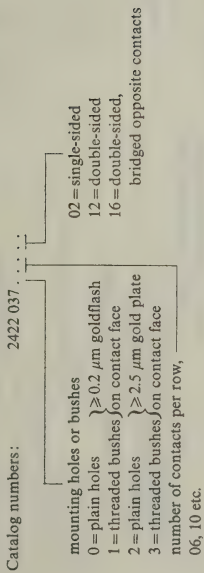
Type number : F 047
 Colour : blue
 Contact pitch : 0.156" (3.96 mm)
 Number of connections : 6, 10, 15, 18, 22, single-sided
 12, 20, 30, 36, 44, double-sided
 Max. r.m.s. voltage : 250 V
 Max. current at $\leq 85^{\circ}\text{C}$: 5 A
 Material of body : glass fibre filled diallylphthalate
 Contact termination : solder tag
 Catalog number : 2422 037

mounting holes or bushes
 4 = threaded bushes $\geq 2.5\text{ }\mu\text{m}$ gold
 5 = plain holes } plate on contact face
 6 = threaded bushes $\geq 1.3\text{ }\mu\text{m}$ gold
 7 = plain holes } plate on contact face
 number of contacts per row, _____
 06, 10 etc.



number of contact springs per row	a_{\max}	b	c_{\max}	d
6	47.3	38.9	32.6	27.9
10	63.2	54.8	48.4	43.8
15	83.0	74.6	68.3	63.6
18	94.9	86.5	80.2	75.5
22	110.7	102.4	96.1	91.3

Type number : F 050
 Colour : green
 Material of body : glass fibre filled polyester
 For further data, see F 047



Type number	: F 053
Colour	: red
Contact pitch	: 0.156" (3.96 mm)
Number of connections	
single-sided	: 6, 10, 15, 18, 22, 28, 36, 43
double-sided	: 12, 20, 30, 36, 44, 56, 72, 86
Max. r.m.s. voltage	: 250 V
Max. current at $\leq 23^{\circ}\text{C}$:	5 A
Material of body	: glass fibre filled polycarbonate

Catalog number : 24220

termination code

39 = pins for wire-wrapping

44=dipsolder pins

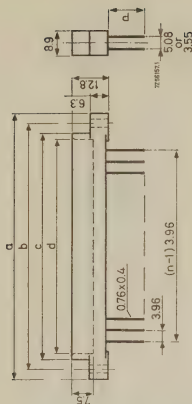
number of contacts per row 06, 10, etc.	

0 = plain holes) pitch of opposite

1'-threaded bushes } terminations 5.08 mm

4 = plain holes } pitch of opposite

5=threaded bushes } terminations 3.55 mm



P = 13 mm for wire-wrap terminations
3.75 mm for dip solder terminations

 $\lambda_{02} = \text{single-sided} \geq 1.3 \mu\text{m}$ gold plate

12=double-sided } on contact face

 $42 = \text{single-sided } \gamma \geq 0.2 \mu\text{m gold flash}$

52 = double-sided } on contact face

number of contacts per row (n)	a_{\max}	b	c_{\max}	d
6	47.34	38.91	32.56	27.94
10	63.19	54.76	48.43	43.79
15	83.00	74.62	68.27	63.60
18	94.89	86.51	80.18	75.49
22	110.7	102.41	96.06	91.34
28	134.21	126.09	118.97	115.11
36	166.19	157.99	150.67	146.76
43	193.82	185.47	178.61	174.55

Type number : F 045
 Colour : black
 Contact pitch : 0.2" (5.08 mm)
 Number of connections: 1 to 54, single-sided
 2 to 108, double-sided
 Max. r.m.s. voltage : 250 V
 Max. current at $\leq 58^{\circ}\text{C}$: 5 A
 Material of body : tropic proof phenolic resin
 Catalog number : 2422 0 . . 5 . .

termination code

20 = solder tags

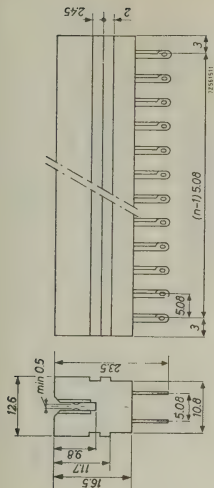
35 = wire-wrap pins

version, see table

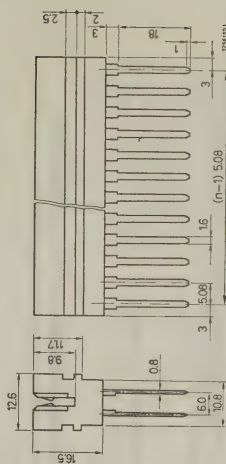
number of contact positions

single-sided (n), 03, 04,

etc., 10 or up to 54



Connector with solder tags



Connector with wire-wrap pins

<i>version</i>	<i>number of contact positions containing a contact</i>	<i>version indication</i>
single-sided	all	02 } for a board thickness
double-sided	all	12 } of 1.6 mm
single-sided	all but the two outermost	04 } $\geq 0.75 \mu\text{m}$ gold plate on
double-sided	all but the four outermost	14 } contact face
single-sided	all	22 } for a board thickness of 2.4 mm
double-sided	all	32 } $\geq 0.75 \mu\text{m}$ gold plate on contact
single-sided	all but the two outermost	24 } face
double-sided	all but the four outermost	34 }
single-sided	all four	42 }
double-sided	all	52 } for a board thickness of 1.6 mm
single-sided	all but the two outermost	44 } $\geq 0.2 \mu\text{m}$ gold flash on
double-sided	all but the four outermost	54 } contact face
single-sided	all	62 }
double-sided	all	72 } for a board thickness of 2.4 mm
single-sided	all but the two outermost	64 } $\geq 0.2 \mu\text{m}$ gold flash on
double-sided	all but the four outermost	74 } contact face

: F 057

Colour : blue

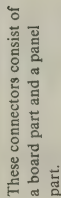
Contact pitch : 0.05" (1.27 mm)

Number of connections : 48, 84, 116 (double-sided)

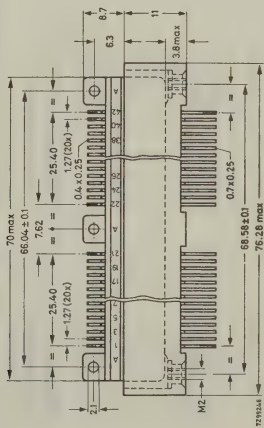
Max. r.m.s. voltage : 100 V

Max. current at $\leq 65^{\circ}\text{C}$: 2 A

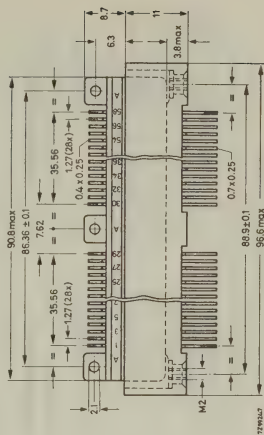
Material of body : glass fibre filled diallylphthalate



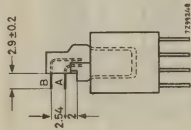
Connector with 48 connections
*) See various terminal configurations



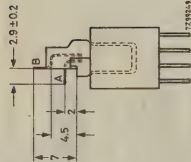
Connector with 84 connections



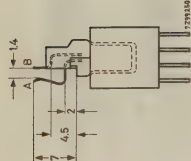
Connector with 116 connections



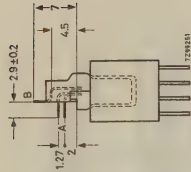
Terminal configuration A



Terminal configuration B



Terminal configuration C

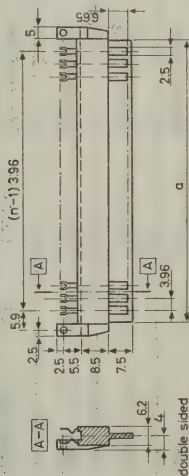


Terminal configuration D

number	connections	terminal configuration of the board part	catalog number	
			board part	panel part
48	A		2422 025	89136
	B			89137
	C		2422 025	89139
	D			89167
84	A			89157
	B			89158
	C		2422 025	89162
	D			89169
116	A			89147
	B			89148
	C		2422 025	89152
	D			89172

Printed-wiring interconnectors

Type number : F048
Colour : blue
Contact pitch : 0.156" (3.96 mm)
Max. r.m.s. voltage : 250 V
Max. curr. at $\leq 80^{\circ}\text{C}$: 5 A
Material of body : glass fibre filled diallylphthalate



Type number : F 051

Colour : green

Material of body : thermosetting, glass fibre filled polyester

For further data, see F 048

number of contact springs per row (n)	a (mm)	catalog number	
		single-sided version	double-sided version
6	27.74	2422 025 89033	2422 025 89038
10	43.58	89034	89039
15	63.40	89035	89041
18	75.30	89036	89042
22	91.10	89037	89043

number of contact springs per row (n)	catalog number	
	single-sided version	double sided version
6	2422 025 89.71	2422 025 89.76
10	2422 025 89.72	2422 025 89.77
15	2422 025 89.73	2422 025 89.78
18	2422 025 89.74	2422 025 89.79
22	2422 025 89.75	2422 025 89.81

0 = $\geq 3 \mu\text{m}$ rolled gold finish of
2 = $\geq 0.2 \mu\text{m}$ goldflash contact face

ELECTRO-MECHANICAL COMPONENTS

Mounting chassis for printed-wiring boards

All chassis are metal frames which can be mounted in standard 19 inch racks. Board thickness 1.6 ± 0.2 mm.

<i>connectors</i>		<i>printed-wiring boards</i>				
<i>type</i>	<i>contact pitch (mm)</i>	<i>numbers of contacts</i>	<i>method of connection</i>	<i>dimensions h x l (mm)</i>	<i>min. pitch in chassis (mm)</i>	<i>max. number chassis (cat. number)</i>
F054	2.54	2 x 32	mini wire-wrap back panel dip soldering	116.8 x 98	10.16	41 4322 026 38250 4322 026 38280
F047 or F050 F053	3.96	1 or 2 x 22	hand soldering mini wire-wrap	116.8 x 110	10.16	41 4322 026 38310
F047 or F050	3.96	1 or 2 x 22	hand soldering	121.8 x 204	19.35 12.9	21 30 4322 026 38230 4322 026 38260
F053	3.96	1 or 2 x 22	mini wire-wrap	121.8 x 204	19.35 12.9	21 30 4322 026 38230 4322 026 38260
special F045	5.08	1 or 2 x 23	hand soldering or wire-wrap	121.8 x $\begin{cases} 204 \\ \text{or} \\ 180 \end{cases}$	19.35 12.9	21 30 4322 026 38240 4322 026 38270

Printed-wiring boards

to fit chassis 4322 026	ma- terial	con- tacts	contact pitch	hole ϕ (mm)	with extractor	dimensions (mm)	cat. number 4322 026
<i>For general purposes</i>							
38230	gl.	2 \times 22	0.156"	0.8	\times	121.8 \times 207.0	38640
38240	gl.	2 \times 23	0.2"	0.8	\times	121.8 \times 207.0	38650
—	ph.	2 \times 38	0.2"	1.3	—	200 \times 396	34900
—	ph.	4 \times 38	0.2"	—	—	200 \times 396	34910
38240	ph.	1 \times 23	0.2"	1.3	—	121.8 \times 180.3	34940
38230	ph.	2 \times 22	0.156"	1.3	\times	121.8 \times 207.0	38620
38240	ph.	2 \times 23	0.2"	1.3	\times	121.8 \times 207.0	38630
38240	gl.	2 \times 23	0.2"	1.3	\times	121.8 \times 207.0	38690
—	ph.	2 \times 10	0.2"	1.3 pt.	—	50.8 \times 58.4	73780
38310	gl.	2 \times 35	0.1"	0.8 pt.	—	116.8 \times 110.2	74670
38250	gl.	2 \times 32	0.1"	0.8 pt.	—	98.2 \times 116.8	39880
38280							
38250	gl.	2 \times 32	0.1"	0.8 pt.	—	98.2 \times 116.8	39890
38280							
<i>For 1-Series circuit blocks (0.2" grid)</i>							
exp.	ph.	2 \times 38	0.2"	1.3	—	200 \times 396	34900
exp.	ph.	4 \times 38	0.2"	—	—	200 \times 396	34910
exp.	ph.	2 \times 22	0.156"	1.3	\times	121.8 \times 207.0	38620
exp.	ph.	2 \times 23	0.2"	1.3	\times	121.8 \times 207.0	38630
exp.	gl.	2 \times 23	0.2"	1.3	\times	121.8 \times 207.0	38690
exp.	ph.	1 \times 23	0.2"	1.3	—	121.8 \times 180.3	34940
univ.	ph.	1 \times 23	0.2"	1.3	—	121.8 \times 180.3	34920
univ. (8 blocks)	ph.	1 \times 23	0.2"	1.2 pt.	—	121.8 \times 180.3	34960
univ.	ph.	1 \times 23	0.2"	1.2 pt.	—	121.8 \times 180.3	36310
for 4 blocks PA 1	gl.	1 \times 23	0.2"	1.2 pt.	—	121.8 \times 180.3	33630
for 4 blocks PD 1	gl.	1 \times 23	0.2"	1.2 pt.	—	121.8 \times 180.3	34710

¹⁾ For dual-in-line packages with 2 \times 7 pins, ²⁾ For dual-in-line packages with a different number of pins.

ELECTRO-MECHANICAL COMPONENTS

	to fit chassis 4322 026.....	ma- terial	con- tacts	contact pitch	hole Ø (mm)	with extractor	dimensions (mm)	cat. number 4322 026.....
<i>For 10-Series circuit blocks</i>								
(0.1" grid)								
univ. (8 blocks)	38240	ph.	1 × 23	0.2"	1.2 pt.	—	121.8 × 180.3	34950
exp. (20 blocks)	38240	gl.	2 × 23	0.2"	1.2 pt.	×	121.8 × 207.0	38600
exp. (20 blocks)	38240	ph.	2 × 23	0.2"	1.2 pt.	×	121.8 × 207.0	38610
exp. (10 low cases)	38220 38240	ph.	2 × 23	0.2"	1.2 pt.	—	121.8 × 200.6	36270
for 4 blocks PA10	38240	gl.	2 × 23	0.2"	pt.	×	121.8 × 207.0	38680
of assembly DCA10	38240	gl.	2 × 23	0.2"	pt.	×	121.8 × 207.0	38700
of assembly 2.DCA11	38240	gl.	2 × 23	0.2"	pt.	×	121.8 × 207.0	38710
of assembly 2.DCA12	38240	gl.	2 × 23	0.2"	pt.	×	121.8 × 207.0	38720
of assembly BCA10	38240	gl.	2 × 23	0.2"	pt.	×	121.8 × 207.0	38730
of assembly 2.SRA10	38240	gl.	2 × 23	0.2"	pt.	×	121.8 × 207.0	38740
of assembly RSR10	38240	gl.	2 × 23	0.2"	pt.	×	121.8 × 207.0	38750

For Norbits 60-Series

exp.	38240	gl.	2 × 23	0.2"	1.2 pt.	×	121.8 × 207.0	38600
exp.	38240	ph.	2 × 23	0.2"	1.2 pt.	×	121.8 × 207.0	38610
with 0 V and + tracks ¹⁾	38230	gl.	2 × 22	0.156"	1.3 pt.	×	121.8 × 207.0	38790
with 0 V and + tracks ¹⁾	38230	ph.	2 × 22	0.156"	1.3 pt.	×	121.8 × 207.0	38800
with 0 V and + tracks ¹⁾	38240	gl.	2 × 23	0.2"	1.3 pt.	×	121.8 × 207.0	38810
with 0 V and + tracks ¹⁾	38240	ph.	2 × 23	0.2"	1.3 pt.	×	121.8 × 207.0	38820
with 0 V and + tracks, and F054 connector ²⁾	38250	gl.	2 × 32	0.1"	1.2	×	116.8 × 98	38780
univ.	38330	gl.	—	—	1.2	—	88.9 × 182.9	73750

The p.w. board thickness is 1.6 mm

The contacts are gold plated.

Abbreviations: -exp. = experimenters' p.w. board

univ. = p.w. board universal for the given series of circuit blocks

gl. = glass epoxy

ph. = phenol paper

p.t. = plated-through

CERAMIC CAPACITORS

Colour code

	temperature coefficient	first digit	second digit	multiplier for the capacitance	tolerance on capacitance $C \leq 10 \text{ pF}$ $C > 10 \text{ pF}$ (pF) (%)	
red/violet	P100					
black	NP0		0	1		± 20
brown	N033	1	1	10	± 0.1	± 1
red	N075	2	2	10^2	± 0.25	± 2
orange	N150	3	3	10^3		
yellow	N220	4	4	10^4		
green	N330	5	5		± 0.5	± 5
blue	N470	6	6			
violet	N750	7	7			
grey		8	8	10^{-2}		
white		9	9	10^{-1}	± 1	± 10

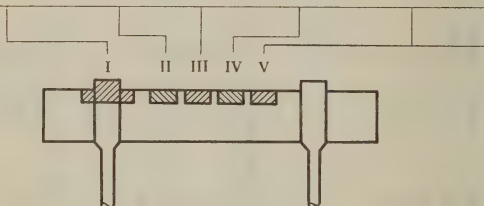
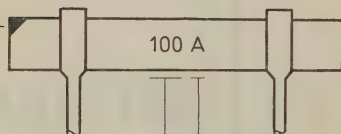


Figure code

colour code for
temp. coefficient,
see Table above



7247547.1

capacitance
value in pF,
using K for
the thousands

code for tolerance
on capacitance: $C \leq 10 \text{ pF}$
tol (pF) code

$C > 10 \text{ pF}$
tol (%) code

0.25

N

1

D

0.5

L

2

C

1

M

5

B

10

A

Miniature plate types, class 1B

Temperature range: -55 to +85°C

Rated voltage: 63 V or 100 V d.c.

Tolerance on capacitance
for $C < 10 \text{ pF}$: $\pm 0.25 \text{ pF}$
for $C \geq 10 \text{ pF}$: $\pm 2\%$

Solderability: 250°C, 5 s max.

size	$B \times H \text{ (mm)}$		
	Fig. 1	Fig. 2, 3	Fig. 4
I	6 × 5	3 × 4	3 × 9
II	6 × 6	4 × 5	4 × 10
III	6 × 7	5 × 6	5 × 11
IV	6 × 8	6 × 7	6 × 11.5
V	6 × 11	6 × 10	6 × 15

Versions:

lead spacing	lead length L	lead diameter	Fig.	catalog number ²⁾
5.08 (0.2 in)	≥ 15	0.6 (0.024 in)	1	2222 638
5.08 (0.2 in)	6(-2)	0.6 (0.024 in)	1	2222 642
2.54 (0.1 in)	≥ 15	0.6 (0.024 in)	2	2222 631
2.54 (0.1 in)	6(-2)	0.6 (0.024 in)	2	2222 641
2.54 (0.1 in)	≥ 15	0.4 (0.016 in) ¹⁾	3	2222 632
3.0	≥ 10	0.6 (0.024 in)	4	2222 643

Dimensions in mm

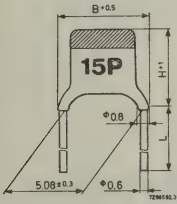


Fig. 1

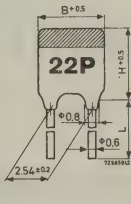


Fig. 2

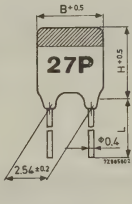


Fig. 3

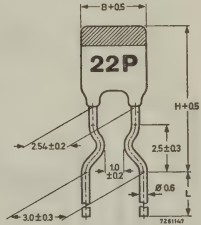


Fig. 4

Max. thickness 2.1 to 2.5 mm

¹⁾ Flexible leads
²⁾ 5 dots to be replaced by code for temperature coefficient and capacitance value given in Tables (suffix).

CERAMIC CAPACITORS

rated voltage		100 V d.c.		100 V d.c.		63 V d.c.		63 V d.c.		63 V d.c.	
temp. coefficient		+100 · 10 ⁻⁶ /deg C		0 · 10 ⁻⁶ /deg C		-75 · 10 ⁻⁶ /deg C		-150 · 10 ⁻⁶ /deg C		-220 · 10 ⁻⁶ /deg C	
cap (pF)	marking	size	suffix	size	suffix	size	suffix	size	suffix	size	suffix
0.68	P68	I	03687								
0.82	P82	I	03827								
1.0	1P0	I	03108								
1.2	1P2	I	03128								
1.5	1P5	I	03158								
1.8	1P8	I	03188	I	09188						
2.2	2P2	I	03228	I	09228						
2.7	2P7	I	03278	I	09278						
3.3	3P3	I	03338	I	09338						
3.9	3P9	II	03398	I	09398	I	27398	I	33398	I	39398
4.7	4P7	II	03478	I	09478	I	27478	I	33478	I	39478
5.6	5P6	II	03568	I	09568	I	27568	I	33568	I	39568
6.8	6P8	II	03688	I	09688	I	37688	I	33688	I	39688
8.2	8P2	III	03828	I	09828	I	27828	I	33828	I	39828
10	10P	III	04109	I	10109	I	28109	I	34109	I	40109
12	12P	IV	04129	I	10129	I	28129	I	34129	I	40129
15	15P	IV	04159	I	10159	I	28159	I	34159	I	40159
18	18P	V	04189	I	10189	I	28189	I	34189	I	40189
22	22P	V	04229	II	10229	II	28229	I	34229	I	40229
27	27P			II	10279	II	28279	II	34279	II	40279
33	33P			II	10339	II	28339	II	34339	II	40339
39	39P			II	10399	II	28399	II	34399	II	40399
47	47P			III	10479	III	28479	II	34479	II	40479
56	56P			III	10569	III	28569	III	34569	III	40569
68	68P			IV	10689	IV	28689	III	34689	III	40689
82	82P			IV	10829	IV	28829	IV	34829	IV	40829
100	n10			V	10101	V	28101	IV	34101	IV	50101
120	n12			V	10121	V	28121	V	34121	V	40121
150	n15							V	34151	V	40151

C100

Miniature plate types, class 1B

Temperature range: -55 to $+85^{\circ}\text{C}$

Rated voltage: 500 V d.c.

Tolerance on capacitance

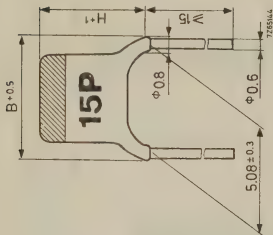
for $C < 10$ pF: $+0.25$ pF

for $C \geq 10$ pF: $+2\%$

Solderability: 250°C, 5 s max

Catalog number: 2222 650

suffix



Max. thickness 2.1 to 2.5 mm

size	$B \times H$ (mm)
I	6×5
II	6×6
III	6×7
IV	6×8
V	6×11

temperature coefficient		+100 · 10 ⁻⁶ /deg C		0 · 10 ⁻⁶ /deg C		-150 · 10 ⁻⁶ /deg C		-750 · 10 ⁻⁶ /deg C		-1500 · 10 ⁻⁶ /deg C	
cap (pF)	marking	size	suffix	size	suffix	size	suffix	size	suffix	size	suffix
0.47	P47	500									
0.68	P68	500	I 03477								
0.82	P82	500	I 03687								
1.0	1P0	500		I	09827						
1.2	1P2	500	I 03108	I	09108						
1.5	1P5	500	I 03128	I	09128						
1.8	1P8	500	I 03158	I	09158						
2.2	2P2	500	I 03188	I	09188					I	57188
2.7	2P7	500	I 03228	I	09228			I	33228	I	57228
			I 03278	I	09278			I	33278	I	57278

temperature coefficient			$+100 \cdot 10^{-6}/\text{deg C}$		$0 \cdot 10^{-6}/\text{deg C}$		$-150 \cdot 10^{-6}/\text{deg C}$		$-750 \cdot 10^{-6}/\text{deg C}$		$-1500 \cdot 10^{-6}/\text{deg C}$
cap (pF)	marking	size	suffix	size	suffix	size	suffix	size	suffix	size	suffix
3.3	3P3	I	03338	I	09338	I	33338	I	57338	I	69828
3.9	3P9	II	03398	I		I	33398	I	57398	I	70109
4.7	4P7	II	03478	I	09478	I	33478	I	57478	I	70129
5.6	5P6	II	03568	II	09568	I	33568	I	57568	I	70159
6.8	6P8	II	03688	II	09688	II	33688	I	57688	I	70189
8.2	8P2	III	03828	II	09828	II	33828	I	57828	I	70229
10	10P	III	04109	II	10109	II	34109	I	58109	I	70279
12	12P	IV	04129	III	10129	II	34129	II	58129	I	70339
15	15P	IV	04159	III	10159	III	34159	II	58159	I	70399
18	18P	IV	04189	IV	10189	III	34189	II	58189	I	70479
22	22P	V	04229	IV	10229	IV	34229	II	58229	I	70569
27	27P	V	04279	IV	10279	IV	34279	III	58279	II	70689
33	33P	500		V	10339	IV	34339	III	58339	II	70829
39	39P	500		V	10399	V	34399	IV	58399	II	70101
47	47P	500				V	34479	IV	58479	II	70121
56	56P	500						IV	58569	II	70151
68	68P	500						V	58689	III	70181
82	82P	500						V	58829	III	70221
100	n10	500								IV	
120	n12	500								IV	
150	n15	500								IV	
180	n18	500								V	
220	n22	500								V	

CERAMIC CAPACITORS

Tubular type, class IB

Temperature range: -40 .to $+85^{\circ}\text{C}$

Rated voltage: 500 V d.c.

Tolerance on capacitance

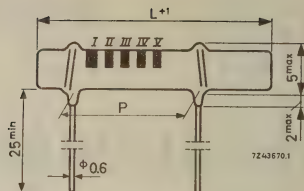
for $C \leq 2.2 \text{ pF}$: $\pm 0.25 \text{ pF}$

for $C = 2.7\text{--}10 \text{ pF}$: $\pm 0.5 \text{ pF}$

for $C > 10 \text{ pF}$: $\pm 5\%$

Catalog number 2222 555

suffix



capacitance (pF)				temperature coefficient								
				NP0: $0.10 \cdot 10^{-6}/\text{deg C}$			N150: $-150.10 \cdot 10^{-6}/\text{deg C}$			N750: $-750.10 \cdot 10^{-6}/\text{deg C}$		
	<i>L</i> (mm)	<i>P</i> (mm)	suffix	<i>L</i> (mm)	<i>P</i> (mm)	suffix	<i>L</i> (mm)	<i>P</i> (mm)	suffix	<i>L</i> (mm)	<i>P</i> (mm)	suffix
0.8										12	7.6	57807
1										12	7.6	57108
1.2										12	7.6	57128
1.5										12	7.6	57158
1.8	12	7.6	09188							12	7.6	57188
2.2	12	7.6	09228							12	7.6	57228
2.7	12	7.6	08278							12	7.6	56278
3.3	12	7.6	08338							12	7.6	56338
3.9	12	7.6	08398							12	7.6	56398
4.7	12	7.6	08478							12	7.6	56478
5.6	12	7.6	08568	12	7.6	32568				12	7.6	56568
6.8	12	7.6	08688	12	7.6	32688				12	7.6	56688
8.2	10	5.1	08828	10	5.1	32828				10	5.1	56828
10	10	5.1	08109	10	5.1	32109				10	5.1	56109
12	10	5.1	08129	10	5.1	32129				10	5.1	56129
15	10	5.1	08159	10	5.1	32159				10	5.1	56159
18	10	5.1	08189	10	5.1	32189				10	5.1	56189
22	10	5.1	08229	10	5.1	32229				10	5.1	56229
27	12	7.6	08279	12	7.6	32279				10	5.1	56279
33	12	7.6	08339	12	7.6	32339				10	5.1	56339
39	12	7.6	08399	12	7.6	32399				10	5.1	56399
47	14	7.6	08479	12	7.6	32479				10	5.1	56479
56	14	7.6	08569	14	7.6	32569				12	7.6	56569
68	16	10.2	08689	16	10.2	32689				12	7.6	56689
82	18	12.7	08829	16	10.2	32829				12	7.6	56829
100	20	15.2	08101	18	12.7	32101				12	7.6	56101
120	22	17.7	08121	20	15.2	32121				14	7.6	56121

capacitance (pF)	temperature coefficient								
	NP0: $0.10 \cdot 10^{-6}/\text{deg C}$			N150: $-150.10^{-6}/\text{deg C}$			N750: $-750.10^{-6}/\text{deg C}$		
	L (mm)	P (mm)	suffix	L (mm)	P (mm)	suffix	L (mm)	P (mm)	suffix
150	26	20.3	08151	24	17.7	32151	16	10.2	56151
180	30	20.3	08181	26	20.3	32181	18	12.7	56181
220	34	25.4	08221	30	20.3	32221	20	15.2	56221
270				36	25.4	32271	22	17.7	56271
330							24	17.7	56331
390							28	20.3	56391
470							32	25.4	56471
560							38	30.5	56561
680							44	35.6	56681
820							52	40.6	56821

Disc type, class 1B

Temperature range: -40 to $+85^{\circ}\text{C}$

Rated voltage: $500\text{ V}_{\text{d.c.}}$

Tolerance on capacitance

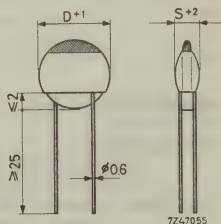
for $C \leq 2.2\text{ pF}$: $\pm 0.25\text{ pF}$

for $C = 2.7\text{--}10\text{ pF}$: $\pm 0.5\text{ pF}$

for $C > 10\text{ pF}$: $\pm 5\%$

Catalog number: 2222 625

suffix



cap. (pF)	temperature coefficient											
	P100: $+100.10^{-6}/^{\circ}\text{C}$			NP0: $0.10^{-6}/^{\circ}\text{C}$			N150: $-150.10^{-6}/^{\circ}\text{C}$			N750: $-750.10^{-6}/^{\circ}\text{C}$		
	D (mm)	S (mm)	suffix	D (mm)	S (mm)	suffix	D (mm)	S (mm)	suffix	D (mm)	S (mm)	suffix
0.5	5	4.5	03507									
0.75	5	3.5	03757									
1.0	5	3	03108									
1.2	5	3	03128									
1.5	5	2.5	03158									
1.8	5	3.5	03188	5	6	09188				5	5.5	56188
2.2	5	3	03228	5	5	09228	5	5.5	33228	5	5	56228
2.7	5	3	02278	5	4.5	08278	5	5	32278	5	4.5	56278

CERAMIC CAPACITORS

cap. temperature coefficient
(pF)

P100: $+100.10^{-6}/^{\circ}\text{C}$ NP0: $0.10^{-6}/^{\circ}\text{C}$ N150: $-150.10^{-6}/^{\circ}\text{C}$ N750: $-750.10^{-6}/^{\circ}\text{C}$

D	S	suffix		D	S	suffix	D	S	suffix	D	S	suffix
(mm)	(mm)			(mm)	(mm)		(mm)	(mm)		(mm)	(mm)	
3.3	5	2.5	02338	5	4.5	08338	5	4.5	32338	5	4	56338
3.9	8	3	02398	5	4	08398	5	4	32398	5	3.5	56398
4.7	8	3	02478	5	3.5	08478	5	3.5	32478	5	3.5	56478
5.6	8	3	02568	5	3	08568	5	3.5	32568	5	3	56568
6.8				5	3	08688	5	3	32688	5	3	56688
8.2				5	2.5	08828	5	3	32828	5	2.5	56828
10				8	3	08109	5	2.5	32109	5	3.5	56109
12				8	3	08129	8	3	32129	5	3.5	56129
15				8	3	08159	8	3	32159	5	3	56159
18							8	3	32189	5	2.5	56189
22										8	3	56229
27										8	3	56279
33										8	3	56339

Miniature plate types, class 2

Temperature range

629 series: -10 to $+55^{\circ}\text{C}$

630-series: -55 to $+85^{\circ}\text{C}$

Rated voltage: 629-series: 40 V d.c.

630-series: 100 V d.c.

Tolerance on capacitance

629-series: -20 to $+100\%$

630-series: $\pm 10\%$

Solderability: 250°C , 5 s max.

size	<i>B</i> × <i>H</i> (mm)		
	Fig. 1	Figs. 2 and 3	Fig. 4
I	6 × 5	3 × 4	3 × 9
II	6 × 6	4 × 5	4 × 10
III	6 × 7	5 × 6	5 × 11
IV	6 × 8	6 × 7	6 × 11.5

Max. thickness 2.1 to 2.5 mm

Versions:

lead spacing	lead length <i>L</i>	lead dia	Fig.	catalog number ²⁾
5.08 (0.2 in)	≥ 15	0.6 (0.024 in)	1	2222 629 03... 2222 630 03...
5.08 (0.2 in)	6 (– 2)	0.6 (0.24 in)	1	2222 629 06... 2222 630 06...
2.54 (0.1 in)	≥ 15	0.6 (0.24 in)	2	2222 629 01... 2222 630 01...
2.54 (0.1 in)	6 (– 2)	0.6 (0.024 in)	2	2222 629 05... 2222 630 05...
2.54 (0.1 in)	≥ 15	0.4 (0.016 in) ¹⁾	3	2222 629 02... 2222 630 02...
3.0	≥ 10	0.6 (0.024 in)	4	2222 629 07... 2222 630 07...

¹⁾ Flexible leads

²⁾ 3 dots to be replaced by catalog number suffix, see Tables below.

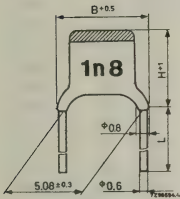


Fig. 1

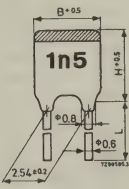


Fig. 2

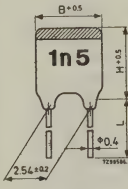


Fig. 3

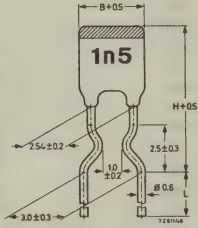


Fig. 4

CERAMIC CAPACITORS

Capacitors 629-series

capacitance (pF)	size	marking	cat. number suffix
1000	I	1n0	102
2200	I	2n2	222
4700	I	4n7	472
10000	II	10n	103
22000	IV	22n	223

Capacitors 630-series

180	I	n18	181
220	I	n22	221
270	I	n27	271
330	I	n33	331
390	I	n39	391
470	I	n47	471
560	I	n56	501
680	I	n68	681
820	I	n82	821
1000	II	1n0	102
1200	II	1n2	122
1500	II	1n5	152
1800	II	1n8	182
2200	III	2n2	222
2700	III	2n7	272
3300	IV	3n3	332
3900	IV	3n9	392
4700	IV	4n7	472

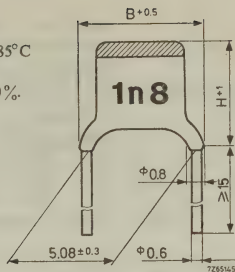
Miniature plate type, class 2A

Temperature range: -55 to $+85^{\circ}\text{C}$

rated voltage 500 V d.c.

Tolerance on capacitance: $\pm 10\%$.

Solderability: 250°C , 55 max.



size	$B \times H$
I	6×5
II	6×6
III	6×7
IV	6×8
V	6×11

Max. thickness 2.1 to 2.5 mm

capacitance (pF)	size	marking	catalog number
100	I	n10 500	2222 655 03101
120	I	n12 500	03121
150	I	n15 500	03151
180	I	n18 500	03181
220	I	n22 500	03221
270	I	n27 500	03271
330	I	n33 500	03331
390	II	n39 500	03391
470	II	n47 500	03471
560	II	n56 500	03561
680	II	n68 500	03681
820	III	n82 500	03821
1000	III	1n0 500	03102
1200	IV	1n2 500	03122
1500	IV	1n5 500	03152
1800	IV	1n8 500	03182
2200	V	2n2 500	03222
2700	V	2n7 500	03272

CERAMIC CAPACITORS

Barrier layer type, class 2

Temperature range: -10 to $+55^{\circ}\text{C}$

Rated voltage: 6 V d.c.

Tolerance on capacitance: -20 to $+100\%$

Solderability: 250°C , 5 s

Catalog number: 2222 675

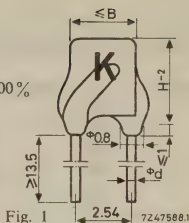


Fig. 1

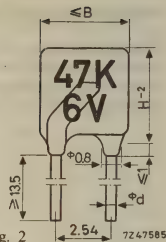


Fig. 2

capacitance (pF)	dimensions		Fig.	cat. number suffix		marking
	B (mm)	H (mm)		version with d=0.6 mm	version with d=0.4 mm	
22000	3.7	5.2	1	01223	02223	K
47000	5.0	6.5	2	01473	02473	47 K, 6 V
100000	5.0	10.5	2	01104	02104	0.1, 6 V

Tubular type, class 2

Temperature range: -40 to $\pm 85^{\circ}\text{C}$

Rated voltage: 500 V d.c.

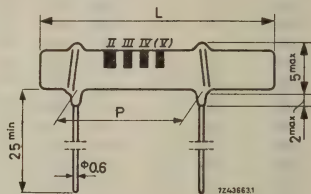
Tolerance on capacitance

552-series: -20 to $+50\%$

561-series: $\pm 10\%$

Catalog numbers: 2222 552 , class 2

2222 561 , class 2A



Capacitors 552-series

capacitance (pF)	L (mm)	P (mm)	cat. number suffix
680	10	5	04681
1000	10	5	04102
1500	10	5	04152
2200	10	5	04222
3300	12	7.6	04332
4700	16	10.2	04472
6800	20	15.2	04682
10000	22	17.7	04103
15000	30	20.3	04153
22000	40	30.5	04223

Capacitors 561-series

capacitance (pF)	L (mm)	P (mm)	cat. number suffix
1000	12	7.6	01102
1500	12	7.6	01152
2200	14	7.6	01222
3300	18	12.7	01332
4700	22	17.7	01472
6800	28	20.3	01682
10000	38	30.5	01103

Upright-counting types, class 2

Temperature range

563-series: -40 to $+85^{\circ}\text{C}$

565-series: -25 to $+85^{\circ}\text{C}$

Rated voltage

563-series: 500 V d.c.

565-series: 125 V d.c.

Catalog numbers: 2222 563

2222 565

Capacitors 563-series

cap. (pF)	tol.	L (mm)	suffix of Fig. 1 versions	suffix of Fig. 2 versions
1.5	1 pF	7	01158	05158
2	1 pF	7.5	01208	05208
3	1 pF	7	01308	05308
4	1 pF	6.5	01408	05408
5	1 pF	7.5	01508	05508
6	1 pF	7.5	01608	05608
7	1 pF	7	01708	05708
8	1 pF	7.5	01808	05808
9	1 pF	8.5	01908	05908
10	1 pF	7.5	01109	05109
15	20%	7.5	02159	06159
22	20%	7.5	02229	06229
33	20%	7	02339	06339
47	20%	9	02479	06479
68	20%	8	02689	06689
100	20%	7.5	02101	06101
150	20%	7.5	02151	06151
220	20%	8	02221	06221
330	20%	9	02331	06331
470	20%	9.5	02471	06471
680	20%	8	02681	06681
1000	$-20/+50\%$	8	03102	07102
1500	$-20/+50\%$	8	03152	07152
2200	$-20/+50\%$	8.5	03222	07222
3300	$-20/+50\%$	11	03332	07332
4700	$-20/+50\%$	14	03472	07472
6800	$-20/+50\%$	19	03682	07682
10000	$-20/+50\%$	27	03103	07103

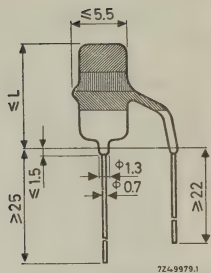


Fig. 1

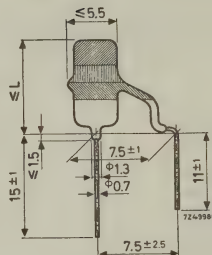


Fig. 2

CERAMIC CAPACITORS

Capacitors 565-series

cap. (pF)	tol.	L (mm)	suffix of Fig. 3 versions
2200	-20/+50 %	8	02222
3300	-20/+50 %	9	02332
4700	-20/+50 %	9.5	02472
6800	-20/+50 %	12	02682
10000	-20/+50 %	16.5	02103

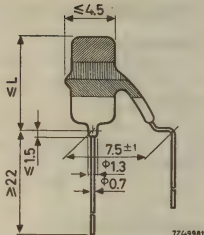
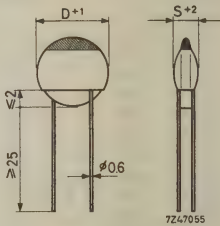


Fig. 3

Disc type, class 2

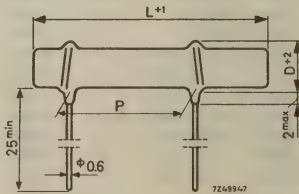
Temperature range: -40 to $+85^{\circ}\text{C}$
Rated voltage: 500 V d.c.
Tolerance on capacitance: -20 to $+50\%$
Catalog number: 2222 627

cap. (pF)	D (mm)	S (mm)	cat. number suffix
220	5	5	14221
330	5	4.5	14331
470	5	3.5	14471
680	5	3	14681
1000	8	3.5	14102
1500	8	3	14152



Tubular type (safety)

Temperature range: -40 to $+85^{\circ}\text{C}$
Rated voltage: 700 V d.c.
Tolerance on capacitance: $\pm 10\%$
Catalog number: 2222 562



cap. (pF)	D (mm)	L (mm)	P (mm)	cat. number suffix
10	3	18	10.2	01109
12	3	18	10.2	01129
15	3	18	10.2	01159
18	3	18	10.2	01189
22	3	18	10.2	01229
27	3	18	10.2	01279
33	3	18	10.2	01339
39	3	18	10.2	01399
47	3	18	10.2	01479
56	4	18	10.2	01569
68	4	18	10.2	01689

cap. (pF)	D (mm)	L (mm)	P (mm)	cat. number suffix
82	4	18	10.2	01829
100	4	20	10.2	01101
120	4	20	10.2	01121
150	4	22	12.7	01151
180	4	24	12.7	01181
220	4	28	17.7	01221
270	4	32	20.3	01271
330	4	36	25.4	01331
390	4	40	30.5	01391
470	4	46	35.6	01471
560	4	52	40.6	01561

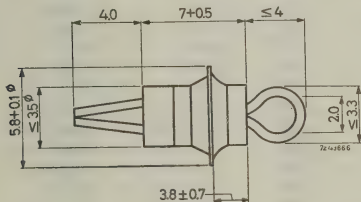
Feed-through types, classes 1 and 2

Temperature range: -40 to $+85^{\circ}\text{C}$

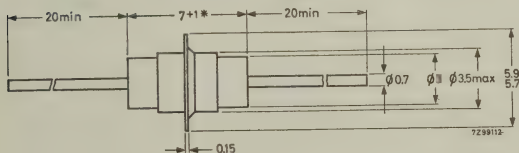
Rated voltage: 350 V d.c.

Catalog numbers: 2222 700 , split pen feed-through capacitors

2222 702 , lead feed-through capacitors



Split pen feed-through capacitors



*) 10^{+1} mm for the 3300pF capacitor
 12^{+1} mm for the 4700pF capacitor

Lead feed-through capacitors

CERAMIC CAPACITORS

Capacitors 700-series

cap. (pF)	tol.	class	cat. number suffix
≤2.5		1C	00258
3.3	±0.5 pF	1C	01338
4.7	±0.5 pF	1C	01478
6.8	±1 pF	1C	02688
10	±1 pF	1C	02109
15	±10%	1C	03159
22	±10%	1C	03229
33	±10%	1C	03339
47	±10%	1C	03479

cap. (pF)	tol.	class	cat. number suffix
68	±20%	2	04689
100	±20%	2	04101
150	±20%	2	04151
220	±20%	2	04221
330	±20%	2	04331
470	±20%	2	04471
680	±20%	2	04681
1000	-20/+50%	2	05102
1500	-20/+50%	2	05152
2200	-20/+50%	2	05222

Capacitors 702-series, class 2

cap. (pF)	tol.	cat. number suffix
2.5	±0.5 pF	04258
3.3	±0.5 pF	04338
4.7	±0.5 pF	04478
6.8	±1 pF	04688
10	±10%	05109
15	±10%	07159
22	±10%	07229
33	±10%	07339
47	±10%	07479

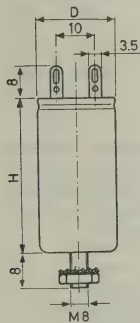
cap. (pF)	tol.	cat. number suffix
68	±10%	08689
100	±20%	08101
150	±20%	08151
220	±20%	08221
330	±20%	08331
470	±20%	08471
680	-20/+50%	09681
1000	-20/+50%	09102
1500	-20/+50%	09152
2200	-20/+50%	09222
3300	-20/+50%	09332
4700	-20/+50%	09472

METALLISED POLYESTER CAPACITORS

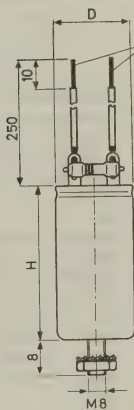
A. C. types

Dielectric: metallised polycarbonate

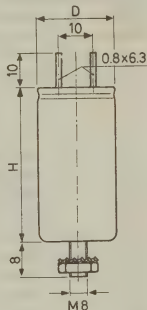
Version A
capacitors with
soldering tags



Version B
capacitors with leads and discharging resistor
0.4 mm²



Version C
capacitors with
flat connections



METALLISED POLYESTER CAPACITORS

Temperature range: -40 to $+85^{\circ}\text{C}$

capacitors 2222 325 : $160\text{ V}_{\text{a.c.}}$

Max. working voltage (40–60 Hz)

capacitors 2222 326 : $220\text{ V}_{\text{a.c.}}$

capacitors 2222 327 : $280\text{ V}_{\text{a.c.}}$

Tolerance on capacitance: $\pm 10\%$

Catalog number: 2222 325 : max. working voltage $160\text{ V}_{\text{a.c.}}$

2222 326 ; max. working voltage $220\text{ V}_{\text{a.c.}}$

2222 327 : max. working voltage $280\text{ V}_{\text{a.c.}}$

version code

50 = version A

52 = version B

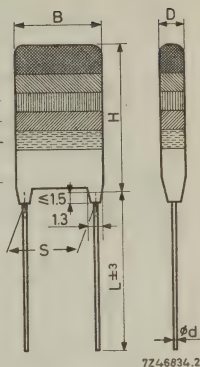
70 = version C

capacitance code, see table

capacitance (μF)	dimensions in mm $D \times H$			capacitance code
	$160\text{ V}_{\text{a.c.}}$	$220\text{ V}_{\text{a.c.}}$	$280\text{ V}_{\text{a.c.}}$	
1.5	—	30×40	30×40	155
2	30×40	30×40	30×40	205
2.5	30×40	30×40	30×40	255
3	30×40	30×40	30×40	305
3.5	30×40	30×40	30×40	355
4	30×40	30×40	30×52	405
4.5	30×40	30×40	30×52	455
5	30×40	30×40	30×52	505
6	30×40	30×52	35×52	605
7	30×40	30×52	35×52	705
8	30×40	30×52	35×52	805
9	30×52	30×52	40×52	905
10	30×52	35×52	40×52	106
12	30×52	35×52	—	126
14	35×52	40×52	—	146
16	35×52	40×52	—	166
18	35×52	40×52	—	186
20	40×52	—	—	206
25	40×52	—	—	256

Flat film type

colour					
					1st figure of cap. value
					2nd figure of cap. value
					multiplying factor
					capacitance tolerance
					working voltage
					body colour
black	—	0	1	$\pm 20\%$	
brown	1	1	10	100 V	
red	2	2	10^2	250 V	
orange	3	3	10^3		
yellow	4	4	10^4	400 V	
green	5	5	10^5		
blue	6	6		630 V	
violet	7	7			
grey	8	8			
white	9	9	$\pm 10\%$		



Dielectric: metallised polyethyleneterephthalate

Temperature range: -40 to $+100^\circ\text{C}$

Maximum working voltage: 100 V_{d.c.}, 250 V_{d.c.}, 400 V_{d.c.}, 630 V_{d.c.}

Maximum alternating voltage (50–60 Hz)

100 V_{d.c.} version: 63 V_{a.c.}

250 V_{d.c.} version: 160 V_{a.c.}

400 V_{d.c.} version: 200 V_{a.c.}

630 V_{d.c.} version: 220 V_{a.c.}

Tolerance on capacitance

for $C \leq 0.22 \mu\text{F}$: $\pm 20\%$

for $C > 0.22 \mu\text{F}$: $\pm 10\%$

Solder conditions for printed-wiring boards: 250°C , 5 s

Catalog number: 2222 342

capacitance code, see table

Code for nom. voltage and capacitance tol.:

24 = 20%, 100 V 54 = 20%, 400 V

25 = 10%, 100 V 55 = 10%, 400 V

44 = 20%, 250 V 64 = 20%, 630 V

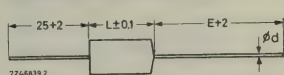
45 = 10%, 250 V 65 = 10%, 630 V

METALLISED POLYESTER CAPACITORS

cap. (μF)	100 $V_{d.c.}$			250 $V_{d.c.}$			400 $V_{d.c.}$			630 $V_{d.c.}$			cap code
	max. dimensions (mm)			max. dimensions (mm)			max. dimensions (mm)			max. dimensions (mm)			
	D	B	H	D	B	H	D	B	H	D	B	H	
0.010				4	12.5	9	4	12.5	9	4	12.5	9	103
0.015				4	12.5	9	4	12.5	9	5	12.5	10	153
0.022				4	12.5	9	4	12.5	9	6	12.5	11	223
0.033				4	12.5	9	5	12.5	10	6	17.5	11	333
0.047				4	12.5	9	6	12.5	11	7	17.5	12	473
0.068				5	12.5	10	6	17.5	11	6.5	22.5	11.5	683
0.10	4	12.5	9	6	12.5	11	7	17.5	12	7.5	22.5	12.5	104
0.15	4.5	12.5	9.5	6	17.5	11	6.5	22.5	11.5	9.5	22.5	14.5	154
0.22	5.5	12.5	10.5	7	17.5	12	7.5	22.5	12.5	9.5	30	14.5	224
0.33	5.5	17.5	11	6.5	22.5	11.5	9.5	22.5	14.5	10	30	18	334
0.47	6.5	17.5	11.5	7.5	22.5	12.5	9.5	30	14.5	12	30	20	474
0.68	6	22.5	11	9.5	22.5	14.5	10	30	18				684
1.0	7	22.5	12	9.5	30	14.5	12	30	20				105
1.5	8.5	22.5	13.5	10	30	18							155
2.2	8.5	30	13.5	12.5	30	20.5							225
3.3	9	30	17										335
4.7	11.5	30	19.5										475
6.8	14	30	22										685

If $B=12.5$	$d=0.6$	$S=10.2 \pm 0.5$	$L=22 \pm 4$
17.5	0.8	15.2 ± 0.3	32 ± 4
22.5	0.8	20.3 ± 0.3	30 ± 4
30	0.8	27.9 ± 0.3	28 ± 4

Moulded type ("Mepolesco")



Temperature range: -55 to $+100^{\circ}\text{C}$

Max. working voltage: 100 $V_{d.c.}$, 250 $V_{d.c.}$,
400 $V_{d.c.}$, 630 $V_{d.c.}$,
1000 $V_{d.c.}$, 1600 $V_{d.c.}$

Tolerance on capacitance

for $C \leq 0.22 \mu\text{F}$: $\pm 20\%$
for $C > 0.22 \mu\text{F}$: $\pm 10\%$

Max. alternating voltage (50–60 Hz)

100 $V_{d.c.}$ version: 63 $V_{a.c.}$,
250 $V_{d.c.}$ version: 160 $V_{d.c.}$,
400 $V_{d.c.}$ version: 200 $V_{d.c.}$,
630 $V_{d.c.}$ version: 220 $V_{a.c.}$,
1000 and 1600 $V_{d.c.}$ versions: 250 $V_{a.c.}$

Catalog number: 2222 341

capacitance code, see tables

Code for max. working voltage, capacitance tolerance and dielectric:

polyethyleneterephthalate

28 = 100 $V_{d.c.}$, 20%	61 = 630 $V_{d.c.}$, 10%	26 = 100 $V_{d.c.}$, 20%
29 = 100 $V_{d.c.}$, 10%	70 = 1000 $V_{d.c.}$, 20%	27 = 100 $V_{d.c.}$, 10%
58 = 400 $V_{d.c.}$, 20%	71 = 1000 $V_{d.c.}$, 10%	88 = 250 $V_{d.c.}$, 20%
59 = 400 $V_{d.c.}$, 10%	80 = 1600 $V_{d.c.}$, 20%	89 = 250 $V_{d.c.}$, 10%
60 = 630 $V_{d.c.}$, 20%	81 = 1600 $V_{d.c.}$, 10%	

cap. (μF)	100 $V_{d.c.}$			250 $V_{d.c.}$			400 $V_{d.c.}$			cap code
	dimensions (mm)			dimensions (mm)			dimensions (mm)			
	A	B	L	A	B	L	A	B	L	
0.010				8.7	4.7	14.5	8.7	4.7	14.5	103
0.015				8.7	4.7	14.5	8.7	4.7	14.5	153
0.022				8.7	4.7	14.5	8.7	4.7	14.5	223
0.033				8.7	4.7	14.5	9.4	5.5	14.5	333
0.047				8.7	4.7	14.5	10.4	6.5	14.5	473
0.068	8.7	4.7	14.5	9.4	5.5	14.5	10.4	6.5	18	683
0.10	8.7	4.7	14.5	10.4	6.5	14.5	11.5	7.6	18	104
0.15	9.4	5.5	14.5	10.4	6.5	18	11.5	7.4	23.5	154
0.22	10.4	6.5	14.5	11.5	7.6	18	12.8	8.7	23.5	224
0.33	10.4	6.5	18	11.5	7.4	23.5	14.4	10.4	23.5	334
0.47	11.5	7.6	18	12.8	8.7	23.5	14.6	10.4	31	474
0.68	11.5	7.4	23.5	14.4	10.4	23.5	19.5	12.4	31	684
1.0	12.8	8.7	23.5	14.6	10.4	31	22	15	31	105
1.5	14.4	10.4	23.5	19.5	12.4	31				155
2.2	14.6	10.4	31	22	15	31				225
3.3	19.5	12.4	31							335
4.7	22	15	31							475

METALLISED POLYESTER CAPACITORS

cap. (μF)	630 $V_{d.c.}$			1000 $V_{d.c.}$			1600 $V_{d.c.}$			cap. code
	dimensions (mm)			dimensions (mm)			dimensions (mm)			
	A	B	L	A	B	L	A	B	L	
0.001							9.4	5.5	14.5	102
0.0015							10.4	6.5	14.5	152
0.0022							10.4	6.5	18	222
0.0033							10.4	6.5	18	332
0.0047							10.4	6.5	18	472
0.0068							11.5	7.6	18	682
0.01	8.7	4.7	14.5	10.4	6.5	18	11.5	7.4	23.5	103
0.015	9.4	5.5	14.5	11.5	7.6	18	12.8	8.7	23.5	153
0.022	10.4	6.5	14.5	11.5	7.4	23.5	14.4	10.4	23.5	223
0.033	10.4	6.5	18	12.8	8.7	23.5	14.6	10.4	31	333
0.047	11.5	7.6	18	14.4	10.4	23.5	19.5	12.4	31	473
0.068	11.5	7.4	23.5	14.6	10.4	31	22	15	31	683
0.1	12.8	8.7	23.5	19.5	12.4	31				104
0.15	14.4	10.4	23.5	22	15	31				154
0.22	14.6	10.4	31							224
0.33	19.5	12.4	31							334
0.47	22	15	31							474

If $L < 30$ mm: $E = 40$ mm, $d = 0.8$ mm

$L = 31$ mm: $E = 50$ mm, $d = 1$ mm

Moulded type ("Nugget")

Temperature range: -55 to $+100^{\circ}\text{C}$

Max. working voltage: $100\text{ V}_{\text{d.c.}}$, $250\text{ V}_{\text{d.c.}}$, $400\text{ V}_{\text{d.c.}}$,
 $630\text{ V}_{\text{d.c.}}$

Max. alternating voltage (50–60 Hz)

$100\text{ V}_{\text{d.c.}}$ version: $63\text{ V}_{\text{a.c.}}$

$250\text{ V}_{\text{d.c.}}$ version: $160\text{ V}_{\text{a.c.}}$

$400\text{ V}_{\text{d.c.}}$ version: $200\text{ V}_{\text{a.c.}}$

$630\text{ V}_{\text{d.c.}}$ version: $220\text{ V}_{\text{a.c.}}$

Tolerance on capacitance

for $C \leq 0.22\text{ }\mu\text{F}$: $\pm 20\%$

for $C > 0.22\text{ }\mu\text{F}$: $\pm 10\%$

Solder conditions for printed-wiring boards: 250°C , 5 s

Catalog number: 2222 344

capacitance code, see tables

Code for dielectric material, max. working voltage and capacitance tolerance:

polyethyleneterephthalate: polycarbonate

24 = $100\text{ V}_{\text{d.c.}}$, 20 % 20 = $100\text{ V}_{\text{d.c.}}$, 20 %

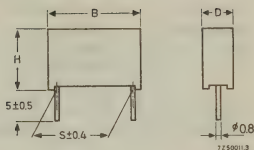
25 = $100\text{ V}_{\text{d.c.}}$, 10 % 21 = $100\text{ V}_{\text{d.c.}}$, 10 %

40 = $250\text{ V}_{\text{d.c.}}$, 20 % 50 = $400\text{ V}_{\text{d.c.}}$, 20 %

41 = $250\text{ V}_{\text{d.c.}}$, 10 % 51 = $400\text{ V}_{\text{d.c.}}$, 10 %

60 = $630\text{ V}_{\text{d.c.}}$, 20 %

61 = $630\text{ V}_{\text{d.c.}}$, 10 %



METALLISED POLYESTER CAPACITORS

capacitance (μF)	100 $V_{\text{d.c.}}$				250 $V_{\text{d.c.}}$				capacitance code
	dimensions (mm)				dimensions (mm)				
	D	B	H	S	D	B	H	S	
0.01					4.5	13	10	10	103
0.015					4.5	13	10	10	153
0.022					4.5	13	10	10	223
0.033					4.5	13	10	10	333
0.047					4.5	13	10	10	473
0.068	4.5	13	10	10	5	13	11	10	683
0.1	4.5	13	10	10	5	17.5	11	15	104
0.15	4.5	13	10	10	6	17.5	11.5	15	154
0.22	5	13	11	10	7	17.5	13	15	224
0.33	5	17.5	11	15	8.5	17.5	14.5	15	334
0.47	6	17.5	11	15	6.5	26	15.5	22.5	474
0.68	7	17.5	13	15	7.5	26	16.5	22.5	684
1.0	8.5	17.5	14.5	15	9.5	26	19	22.5	105
1.5	6.5	26	15.5	22.5	11	30	20.5	27.5	155
2.2	7.5	26	16.5	22.5	13.5	30	22.5	27.5	225
3.3	9.5	26	19	22.5					335
4.7	11	30	20.5	27.5					475
6.8	13.5	30	22	27.5					685

capacitance (μF)	400 $V_{d.c.}$				630 $V_{d.c.}$				capacitance code
	dimensions (mm)				dimensions (mm)				
	D	B	H	S	D	B	H	S	
0.01	4.5	13	10	10	4.5	13	10	10	103
0.015	4.5	13	10	10	5	13	11	10	153
0.022	4.5	13	10	10	6	13	12	10	223
0.033	5	13	11	10	6	17.5	11.5	15	333
0.047	5	17.5	11	15	7	17.5	13	15	473
0.068	6	17.5	11.5	15	8.5	17.5	14.5	15	683
0.1	7	17.5	13	15	6.5	26	15.5	22.5	104
0.15	8.5	17.5	14.5	15	7.5	26	16.5	22.5	154
0.22	6.5	26	15.5	22.5	9.5	26	19	22.5	224
0.33	7.5	26	16.5	22.5	11	30	20.5	27.5	334
0.47	9.5	26	19	22.5	13.5	30	22.5	27.5	474
0.68	11	30	20.5	27.5					684
1.0	13.5	30	22.5	27.5					105

FOIL ON FILM POLYESTER CAPACITORS

Tubular type

Temperature range: -40 to $+85^{\circ}\text{C}$

Max. working voltage: $160\text{ V}_{\text{d.c.}}$ and $400\text{ V}_{\text{d.c.}}$

Max. alternating voltage (50–60 Hz)

$160\text{ V}_{\text{d.c.}}$ version: $90\text{ V}_{\text{a.c.}}$

$400\text{ V}_{\text{d.c.}}$ version: $150\text{ V}_{\text{a.c.}}$

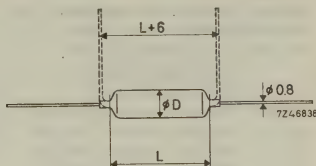
Tolerance on capacitance: $\pm 10\%$

Solderability according to I.E.C. 68–2,

test T3.2

Catalog number: 2222 311 31 ..., working voltage $160\text{ V}_{\text{d.c.}}$

2222 311 51 ..., working voltage $400\text{ V}_{\text{d.c.}}$



capacitance	max. dimensions (mm)				catalog number suffix
	160 $V_{d.c.}$		400 $V_{d.c.}$		
	D	L	D	L	
1000 pF			7.5	18	102
1500			7.5	18	152
2200			7.5	18	222
3300			7.5	18	332
4700			7.5	18	472
6800			7.5	18	682
0.010 μF	7.5	18	7.5	18	103
0.015	7.5	18	7.5	18	153
0.022	7.5	18	8.5	18	223
0.033	7.5	18	10	18	333
0.047	8	18	11.5	18	473
0.068	9	18	9.5	32	683
0.10	10.5	18	11	32	104
0.15	12	18	12.5	32	154
0.22	10	32	14.5	32	224
0.33	12	32	17	32	334
0.47	14	32	19.5	32	474
0.68	16	32			684
1.0	18.5	32			105

Foil on film polyester capacitors

Flat type

Dielectric: polyethyleneterephthalate

Temperature range: -40 to $+85^{\circ}\text{C}$

Maximum working voltage:

100 V d.c., 250 V d.c.

400 V d.c., 630 V d.c.

Maximum alternating voltage (50–60 Hz)

100 V d.c. version: 50 V a.c.

250 V d.c. version: 80 V a.c.

400 V d.c. version: 125 V a.c.

630 V d.c. version: 200 V a.c.

Tolerance on nominal capacitance

$\pm 20\%$ and $\pm 10\%$

Solder conditions for printed-wiring

boards: 250°C , 5 s

Catalog number: 2222 347

Code for
nominal voltage

2 = 100 V

4 = 250 V

5 = 400 V

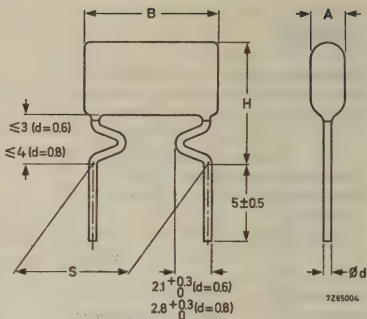
6 = 630 V

code for capacitance
tolerance

0 = $\pm 20\%$

1 = $\pm 10\%$

Capacitance code
see table

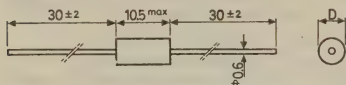


cap. (nF)	marking code	100 $V_{d.c.}$					250 $V_{d.c.}$					cap. code	
		max. dimensions (mm)					max. dimensions (mm)						
		A	B	H	S	d	A	B	H	S	d		
2.2	2n2												222
3.3	3n3												332
4.7	4n7												472
6.8	6n8												682
10	10n						5	13.5	13	10.66	0.6		103
15	15n	4.5	13.5	12.5	10.66	0.6	6	13.5	14	10.66	0.6		153
22	22n	5.5	13.5	13.5	10.66	0.6	6.5	13.5	13.5	15.54	0.8		223
33	33n	6.5	13.5	13.5	10.66	0.6	6	19	15	15.54	0.8		333
47	47n	7	13.5	14	10.66	0.6	7	19	16	15.54	0.8		473
68	68n	6.5	19	15.5	15.54	0.8	8	19	17	15.54	0.8		683
100	100n	7.5	19	16.5	15.54	0.8	6.5	32	18.5	28.24	0.8		104
150	150n	8.5	19	17.5	15.54	0.8	7.5	32	19.5	28.24	0.8		154
220	220n	7	32	19	28.24	0.8	8.5	32	20.5	28.24	0.8		224
330	330n	8	32	20	28.24	0.8	10.5	32	22.5	28.24	0.8		334
470	470n	9.5	32	20.5	28.24	0.8	12.5	32	24.5	28.24	0.8		474
680	680n						15.5	32	27.5	28.24	0.8		684

cap. (nF)	marking code	400 $V_{d.c.}$					630 $V_{d.c.}$					cap. code
		max. dimensions (mm)					max. dimensions (mm)					
		A	B	H	S	d	A	B	H	S	d	
2.2	2n2						4.5	13.5	12.5	10.66	0.6	222
3.3	3n3						5.5	13.5	13.5	10.66	0.6	332
4.7	4n7	4.5	13.5	12.5	10.66	0.6	6.5	13.5	13.5	15.54	0.8	472
6.8	6n8	5.5	13.5	13.5	10.66	0.6	7	13.5	14	15.54	0.8	682
10	10n	6.5	13.5	13.5	15.54	0.6	6.5	19	15.5	15.54	0.8	103
15	15n	7	13.5	14	15.54	0.8	7.5	19	16.5	15.54	0.8	153
22	22n	6.5	19	15.5	15.54	0.8	8.5	19	17.5	15.54	0.8	223
33	33n	7.5	19	16.5	15.54	0.8	7	32	19	28.24	0.8	333
47	47n	8.5	19	17.5	15.54	0.8	8	32	20	28.24	0.8	473
68	68n	7	32	19	28.24	0.8	9.5	32	21.5	28.24	0.8	683
100	100n	8	32	20	28.24	0.8	11.5	32	23.5	28.24	0.8	104
150	150n	9.5	32	21.5	28.24	0.8	14	32	26	28.24	0.8	154
220	220n	11.5	32	23.5	28.24	0.8	16	32	28	28.24	0.8	224
330	330n	14	32	26	28.24	0.8						334
470	470n											474
680	680n											684

POLYSTYRENE CAPACITORS

Miniature type ("Micropoco")



Temperature range

63 V_{d.c.} version: -40 to +70°C

125 V_{d.c.}, 250 V_{d.c.}, 500 V_{d.c.} version: -40 to +85°C

Max. working voltage: 63 V_{d.c.}, 125 V_{d.c.}, 250 V_{d.c.}, 500 V_{d.c.}

Max. alternating voltage

63 V_{d.c.} version: 25 V_{a.c.}

125 V_{d.c.} version: 63 V_{a.c.}

250 V_{d.c.} version: 125 V_{a.c.}

500 V_{d.c.} version: 220 V_{a.c.}

Tolerance on capacitance: ±1%, ±2% and ±5%

Solder conditions for printed-wiring boards: 230°C, 2 s

Catalog number: 2222 42

max. working voltage code

4 = 63 V_{d.c.}

5 = 125 V_{d.c.}

6 = 250 V_{d.c.}

7 = 500 V_{d.c.}

capacitance code, see table

capacitance tolerance code

2 = ±5%

3 = ±2%

4 = ±1%

cap. value (pF)	diameter D (mm)		code
	63 $V_{d.c.}$ versions	125 $V_{d.c.}$ versions	
430		3.0	4301
470		3.0	4701
510		3.0	5101
560		3.5	5601
620		3.5	6201
680		3.5	6801
750		3.5	7501
820	3.0	3.5	8201
910	3.0	3.5	9101
1000	3.0	4.0	1002
1100	3.5	4.0	1102
1200	3.5	4.0	1202
1300	3.5	4.0	1302
1500	3.5	4.0	1502
1600	3.5	4.5	1602
1800	3.5	4.5	1802
2000	3.5	4.5	2002
2200	4.0	5.0	2202
2400	4.0	5.0	2402
2700	4.0	5.0	2702
3000	4.0	5.5	3002
3300	4.5	5.5	3302
3600	4.5	6.0	3602
3900	4.5	6.0	3902
4300	4.5		4302
4700	4.5		4702
5100	5.0		5102
5600	5.0		5602
6200	5.0		6202
6800	5.0		6802

cap. value (pF)	diameter D (mm)		code
	250 $V_{d.c.}$ versions	500 $V_{d.c.}$ versions	
51		3.5	
56		3.5	
62		3.5	
68		3.5	
75		3.5	
82		3.5	
91		3.5	
100		3.5	1001
110		3.5	1101
120		3.5	1201
130		3.5	1301
150		3.5	1501
160		3.5	1601
180	3.5	4.0	1801
200	3.5	4.0	2001
220	3.5	4.0	2201
240	3.5	4.0	2401
270	3.5	4.5	2701
300	3.5	4.5	3001
330	3.5	4.5	3301
360	3.5	4.5	3601
390	3.5	4.5	3901
430	3.5	4.5	4301
470	4.0	5.0	4701
510	4.0	5.0	5101
560	4.0	5.0	5601
620	4.0	5.0	6201
680	4.0	5.0	6801
750	4.0	5.5	7501
820	4.5	5.5	8201
910	4.5	6.0	9101
1000	4.5	6.0	1002
1100	4.5	6.0	1102
1200	5.0	6.5	1202
1300	5.0		1302
1500	5.0		1502
1600	5.5		1602
1800	5.5		1802
2000	5.5		2002
2200	6.0		2202

POLYSTYRENE CAPACITORS

Tubular moulded type ("Minipoco")

Temperature range

63 V_{d.c.} version: -40 to +70°C

125, 250 and 500 V_{d.c.} versions: -40 to +85°C

Max. working voltage: 63 V_{d.c.}, 125 V_{d.c.},

250 V_{d.c.}, 500 V_{d.c.}

Max. alternating voltage

63 V_{d.c.} version: 30 V_{a.c.}

125 V_{d.c.} version: 63 V_{a.c.}

250 V_{d.c.} version: 125 V_{a.c.}

500 V_{d.c.} version: 250 V_{a.c.}

Tolerance on capacitance: ±1%, ±2%, ±5%

Solder conditions for printed-wiring boards: 250°C, 5 s

Catalog number: 2222 43

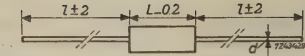
maximum working
voltage code

5 = 63 V_{d.c.}

6 = 125 V_{d.c.}

7 = 250 V_{d.c.}

8 = 500 V_{d.c.}



If L = 15 mm: l = 35 mm, d = 0.7 mm

L = 25 mm: l = 45 mm, d = 0.8 mm

capacitance code, see table

capacitance tolerance code

2 = ±5%

3 = ±2%

4 = ±1%

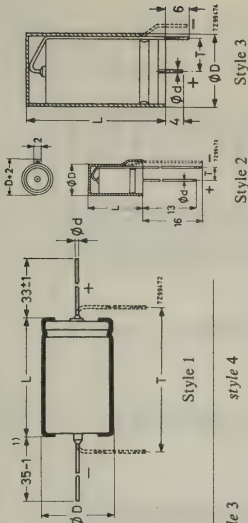
capacitance	dimensions in mm (D × L)				capacitance code
	63 V _{d.c.}	125 V _{d.c.}	250 V _{d.c.}	500 V _{d.c.}	
1300				9 × 15	1302
1500				9 × 15	1502
1600				9 × 15	1602
1800				9 × 15	1802
2000				9 × 15	2002
2200				9 × 15	2202
2400			7.5 × 15	10 × 15	2402
2700			9 × 15	10 × 15	2702
3000			9 × 15	10 × 15	3002
3300			9 × 15	10 × 15	3302
3600			9 × 15	12.5 × 15	3602
3900			9 × 15	12.5 × 15	3902
4300		7.5 × 15	9 × 15	12.5 × 15	4302
4700		9 × 15	9 × 15	12.5 × 15	4702
5100		9 × 15	10 × 15	12.5 × 15	5102
5600		9 × 15	10 × 15	12.5 × 15	5602
6200		9 × 15	10 × 15	10 × 25	6202

capacitance	dimensions in mm ($D \times L$)				capacitance code
	63 $V_{d.c.}$	125 $V_{d.c.}$	250 $V_{d.c.}$	500 $V_{d.c.}$	
6800		9 × 15	12.5 × 15	10 × 25	6802
7500	7.5 × 15	9 × 15	12.5 × 15	10 × 25	7502
8200	7.5 × 15	10 × 15	12.5 × 15	10 × 25	8202
9100	7.5 × 15	10 × 15	12.5 × 15	12.5 × 25	9102
0.010 μF	9 × 15	10 × 15	12.5 × 15	12.5 × 25	1003
0.011	9 × 15	12.5 × 15	12.5 × 15	12.5 × 25	1103
0.012	9 × 15	12.5 × 15	10 × 25	12.5 × 25	1203
0.013	9 × 15	12.5 × 15	10 × 25	12.5 × 25	1303
0.015	9 × 15	12.5 × 15	10 × 25	12.5 × 25	1503
0.016	9 × 15	12.5 × 15	10 × 25	12.5 × 25	1603
0.018	10 × 15	10 × 25	12.5 × 25	15 × 25	1803
0.020	10 × 15	10 × 25	12.5 × 25	15 × 25	2003
0.022	10 × 15	10 × 25	12.5 × 25	15 × 25	2203
0.024	10 × 15	10 × 25	12.5 × 25	15 × 25	2403
0.027	12.5 × 15	12.5 × 25	12.5 × 25		2703
0.030	12.5 × 15	12.5 × 25	15 × 25		3003
0.033 μF	12.5 × 15	12.5 × 25	15 × 25		3303
0.036	12.5 × 15	12.5 × 25	15 × 25		3603
0.039	12.5 × 15	12.5 × 25	15 × 25		3903
0.043	10 × 25	12.5 × 25	15 × 25		4303
0.047	10 × 25	12.5 × 25	15 × 25		4703
0.051	10 × 25	12.5 × 25			5103
0.056	12.5 × 25	15 × 25			5603
0.062	12.5 × 25	15 × 25			6203
0.068	12.5 × 25	15 × 25			6803
0.075	12.5 × 25	15 × 25			7503
0.082	12.5 × 25	15 × 25			8203
0.091	12.5 × 25				9103
0.10	15 × 25				1004
0.11	15 × 25				1104
0.12	15 × 25				1204
0.13	15 × 25				1304
0.15	15 × 25				1504
0.16	15 × 25				1604

ELECTROLYTIC CAPACITORS

Miniature and small types for general purposes

style	case size	IEC 68 category	IEC 103 type	capac. tol. (%)
1 and 2	1	25/070/56	2	-10/+100
1 and 2	2, 3 and 5a	25/085/56	2	-10/+50
1 and 3	4, 5 and 6	40/085/56	1	-10/+50
1, 3 and 4	00 to 03	40/085/56	1	-10/+50



case size	style 1			style 2			style 3			style 4		
	d (mm)	D (mm) max.	T (mm) ² max.	d (mm)	D (mm) max.	T (mm) ² max.	d (mm)	D (mm) max.	T (mm) ² max.	d (mm)	D (mm) max.	T (mm) ² max.
1	0.6	3.5	10.5	6E	4.1	12.5	E					
2	0.6	4.8	12.5	6E	5.6	14.5	E					
3	0.6	6.1	12.5	6E	6.9	14.5	E $\sqrt{2}$					
5a	0.6	8.3	13.5	6E	9.1	14.5	2E					
4	0.6	6.7	20	10E				8.5	24.5	2E		
5	0.6	8.3	20	10E				10.2	24.5	2E		
6	0.6	10.3	20	10E				12.1	24.5	3E		
00	0.8	10.4	32.5	14E				11.2	34.5	3E	12.8	41
01	0.8	12.9	32.5	14E				13.6	34.5	3E	15.2	41
02	0.8	15.4	32.5	14E				16	34.5	4E	17.8	41
03	0.8	18.4	32.5	14E				19	34.5	4E	20.8	41

¹⁾ 55 -- 1 for case sizes 00, 01, 02 and 0.3 ²⁾ E = 2.5 + 0.04 mm.

ELECTROLYTIC CAPACITORS

U_R (V)	capacitance at 100 Hz (μF)	max. ripple current at 100 Hz, upper cat. temp. (mA)	leakage current ¹⁾ (μA) max.	$\tan \delta$ at 100 Hz	impedance at 100 kHz (Ω)	case size	catalog number 2222 followed by		
							style 1	styles 2 + 3	style 4
4	15	10	5	0.25	12	1	015 12159	015 42159	
4	47	26	9	0.25	4	2	015 12479	015 42479	
4	100	44	20	0.25	2	3	015 12101	015 42101	
4	220	70	44	0.25	1	5a	015 12221	015 42221	
4	220	85	9	0.25	0.5	4	016 12221	016 42221	
4	330	125	13	0.25	0.35	5	016 12331	016 42331	
4	1000	325	40	0.25	0.2	00	017 12102	017 42102	017 52102
4	4700	920	170	0.25	0.3	03	017 12472	017 42472	017 52472
6.3	10	12	5	0.20	12	1	015 13109	015 43109	
6.3	33	26	10	0.20	4	2	015 13339	015 43339	
6.3	68	44	21	0.20	2	3	015 13689	015 43689	
6.3	150	70	47	0.20	1	5a	015 13151	015 43151	
6.3	150	85	10	0.20	0.5	4	016 13151	016 43151	
6.3	470	190	30	0.20	0.2	6	016 13471	016 43471	
6.3	680	325	43	0.20	0.2	00	017 13681	017 43681	017 53681
6.3	1500	470	95	0.20	0.2	01	017 13152	017 43152	017 53152
6.3	2200	630	140	0.20	0.25	02	017 13222	017 43222	017 53222
6.3	3300	920	210	0.20	0.3	03	017 13332	017 43332	017 53332

¹⁾ After 5 min. (20°C).

U_R (V)	capacitance at 100 Hz (μF)	max. ripple current at 100 Hz, upper cat. temp. (mA)	leakage current ¹⁾ (μA) max.	tan δ at 100 Hz	impedance at 100 kHz (Ω)	case size	catalog number 2222 followed by		
							style 1	styles 2 + 3	style 4
10	6.8	12	5	0.16	12	1	015 14688	015 44688	
10	22	26	11	0.16	4	2	015 14229	015 44229	
10	47	44	24	0.16	2	3	015 14479	015 44479	
10	100	70	50	0.16	1	5a	015 14101	015 44101	
10	100	85	10	0.16	0.5	4	016 14101	016 44101	
10	220	125	22	0.16	0.35	5	016 14221	016 44221	
10	330	190	33	0.16	0.2	6	016 14331	016 44331	
10	470	325	43	0.16	0.2	00	017 14471	017 44471	017 54471
10	1000	470	100	0.16	0.2	01	017 14102	017 44102	017 54102
10	1500	630	150	0.16	0.25	02	017 14152	017 44152	017 54152
10	2200	920	220	0.16	0.3	03	017 14222	017 44222	017 54222
16	4.7	12	5	0.12	12	1	015 15478	015 45478	
16	15	26	12	0.12	4	2	015 15159	015 45159	
16	33	44	26	0.12	2	3	015 15339	015 45339	
16	68	70	54	0.12	1	5a	015 15689	015 45689	
16	68	85	11	0.12	0.5	4	016 15689	016 45689	
16	150	125	24	0.12	0.35	5	016 15151	016 45151	
16	220	190	35	0.12	0.2	6	016 15221	016 45221	
16	330	325	53	0.12	0.2	00	017 15331	017 45331	017 55331
16	680	470	109	0.12	0.2	01	017 15681	017 45681	017 55681
16	1000	630	160	0.12	0.25	02	017 15102	017 45102	017 55102
16	1500	920	240	0.12	0.3	03	017 15152	017 45152	017 55152

¹⁾ After 5 min. (20° C).

ELECTROLYTIC CAPACITORS

U_R (V)	capacitance at 100 Hz (μF)	max. ripple current at 100 Hz, upper cat. temp. (mA)	leakage current ¹⁾ (μA) max.	$\tan \delta$ at 100 Hz	impedance at 100 kHz (Ω)	case size	catalog number 2222 followed by	style 1	styles 2 + 3	style 4
25	3.3	11	5	0.10	12	1	015 16338	015 16338	015 46338	
25	10	23	13	0.10	4	2	015 16109	015 16109	015 46109	
25	22	37	28	0.10	2	3	015 16229	015 16229	015 46229	
25	47	60	59	0.10	1	5a	015 16479	015 16479	015 46479	
25	47	72	12	0.10	0.5	4	016 16479	016 16479	016 46479	
25	100	105	25	0.10	0.35	5	016 16101	016 16101	016 46101	
25	150	155	38	0.10	0.2	6	016 16151	016 16151	016 46151	
25	220	270	55	0.10	0.2	00	017 16221	017 16221	017 46221	017 56221
25	470	360	118	0.10	0.2	01	017 16471	017 16471	017 46471	017 56471
25	680	500	170	0.10	0.25	02	017 16681	017 16681	017 46681	017 56681
25	1000	650	250	0.10	0.3	03	017 16102	017 16102	017 46102	017 56102
40	2.2	11	5	0.08	12	1	015 17228	015 17228	015 47228	
40	6.8	23	14	0.08	4	2	015 17688	015 17688	015 47688	
40	15	37	30	0.08	2	3	015 17159	015 17159	015 47159	
40	33	60	66	0.08	1	5a	015 17339	015 17339	015 47339	
40	33	72	14	0.08	0.5	4	016 17339	016 17339	016 47339	
40	47	105	19	0.08	0.35	5	016 17479	016 17479	016 47479	
40	100	155	40	0.08	0.2	6	016 17101	016 17101	016 47101	
40	150	270	60	0.08	0.2	00	017 17151	017 17151	017 47151	017 57151
40	220	360	88	0.08	0.2	01	017 17221	017 17221	017 47221	017 57221
40	470	500	188	0.08	0.25	02	017 17471	017 17471	017 47471	017 57471
40	680	650	272	0.08	0.3	03	017 17681	017 17681	017 47681	017 57681

¹⁾ After 5 min. (20°C).

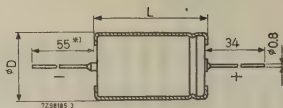
U_R (V)	capacitance at 100 Hz (μF)	max. ripple current at 100 Hz upper cat. temp. (mA)	leakage current ¹⁾ (μA) max.	$\tan \delta$ at 100 Hz	impedance at 100 kHz (Ω)	case size	catalog number	
							style 1	styles 2 + 3 style 4
63	0.47	7	5	0.06	5	3	015 18477	015 48477
63	0.47	6	1	0.06	4	4	016 18477	016 48477
63	1	10	5	0.06	3	3	015 18108	015 48108
63	1	12	1	0.06	2	4	016 18108	016 48108
63	1.5	9	5	0.06	12	1	015 18158	015 48158
63	1.5	12	5	0.06	2.5	3	015 90001	015 90002
63	2.2	15	7	0.06	2	3	015 18228	015 48228
63	2.2	21	1.5	0.06	1.4	4	016 18228	016 48228
63	3.3	17	11	0.06	2	3	015 18338	015 48338
63	4.7	22	15	0.06	2	3	015 90003	015 90004
63	4.7	18	15	0.06	4	2	015 18478	015 48478
63	4.7	31	3	0.06	1.2	4	016 18478	016 48478
63	6.8	25	22	0.06	2	3	015 18688	015 48688
63	10	30	32	0.06	2	3	015 18109	015 48109
63	10	44	6.5	0.06	0.6	4	016 18109	016 48109
63	15	43	47	0.06	1	5a	015 18159	015 48159
63	15	55	10	0.06	0.5	4	016 18159	016 48159
63	22	80	14	0.06	0.35	5	016 18229	016 48229
63	47	115	30	0.06	0.2	6	016 18479	016 48479
63	68	195	43	0.06	0.2	00	017 18689	017 48689
63	100	240	63	0.06	0.2	01	017 18101	017 48101
63	150	280	95	0.06	0.2	01	017 18151	017 48151
63	220	360	139	0.06	0.25	02	017 18221	017 48221
63	330	495	208	0.06	0.3	03	017 18331	017 48331

¹⁾ After 5 min. (20°C).

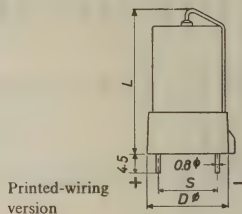
ELECTROLYTIC CAPACITORS

Small type for high voltages

can size	axial version		printed-wiring version		
	<i>D</i> (mm)	<i>L</i> (mm)	<i>D</i> (mm)	<i>L</i> (mm)	<i>S</i> (mm)
0	10.4	18.5	12.8	26	10.16
00	10.4	30.5	12.8	39.3	10.16
01	12.9	30.5	15.2	39.3	10.16
02	15.4	30.5	17.8	39.3	12.70
03	18.5	30.5	20.8	39.3	15.24



Axial version
(insulated)



*) 35 mm for can size 00

Temperature range: -40 to $+70^{\circ}\text{C}$

Tolerance on capacitance: -10 to $+30\%$

Catalog number: 2222 040 1, axial version

2222 040 4, printed-wiring version

can size	working voltage ($V_{d.c.}$)	capac- itance (μF)	leakage current ¹⁾ (μA)	ripple current ²⁾ (mA)	dissi- pation factor ³⁾	impe- dance ⁴⁾ (Ω)	catalog number suffix
00	100	20	85	50	0.15	6.4	0209
01	100	32	130	75	0.15	4.0	0329
02	100	50	180	100	0.15	2.5	0509
03	100	80	270	125	0.15	1.6	0809
0	150	6.4	55	25	0.15	15.0	1648
00	150	12.5	85	50	0.15	8.0	1139
01	150	20	130	75	0.15	5.0	1209
02	150	32	180	100	0.15	3.0	1329
03	150	50	270	125	0.15	2.0	1509
00	200	10	85	25	0.15	8.0	2109
01	200	16	130	50	0.15	5.0	2169
02	200	25	180	75	0.15	3.0	2259
03	200	40	270	100	0.15	2.0	2409
0	250	4	55	25	0.15	20.0	3408
00	250	8	85	25	0.15	10.0	3808
01	250	12.5	130	50	0.15	6.4	3139
02	250	20	180	75	0.15	4.0	3209
03	250	32	270	100	0.15	2.5	3329
00	300	6.4	85	25	0.15	20.0	4648
01	300	10	130	50	0.15	15.0	4109
02	300	16	180	75	0.15	8.0	4169
03	300	25	270	100	0.15	5.0	4259
0	350	2.5	55	25	0.15	60.0	5258
00	350	5	85	25	0.15	30.0	5508
01	350	8	110	25	0.15	20.0	5808
02	350	12.5	160	50	0.15	15.0	5139
03	350	20	240	75	0.15	8.0	5209
00	400	4	85	25	0.15	45.0	6408
01	400	6.4	110	25	0.15	30.0	6648
02	400	10	160	50	0.15	20.0	6109
03	400	16	240	75	0.15	12.5	6169

1) Maximum leakage current at 20°C after 5 minutes.

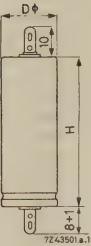
2) Maximum permissible ripple current at 100 Hz and 70°C .

3) Maximum dissipation factor ($\tan \delta$) at 20°C and 50 Hz.

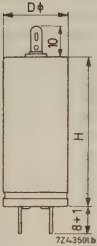
4) Maximum impedance at 20°C and 100 kHz.

ELECTROLYTIC CAPACITORS

Large types for high and low voltages



Can sizes
4, 5, 6

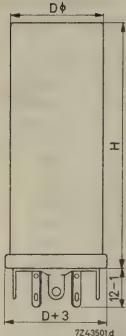


Can sizes
3, 4, 5, 6

Capacitors with soldering terminals



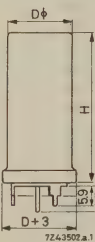
Can sizes
6T, 7



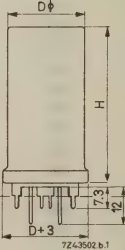
Can sizes
8, 9

Capacitors with twistable mounting lugs

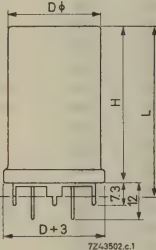
case size	D (mm)	H (mm)	L
3	19	34	36
4	19	50	52
5	22	50	52
6	26	50	
6T	26	52	55
7	26	81	
8	31	81	
8A	31	52	55
9	36	81	
9A	36	52	55



Can sizes 4, 5



Can size 6T



Can sizes 8A, 9A

Capacitors for printed-wiring boards

Temperature range: -40 to $+70^{\circ}\text{C}$

Tolerance on capacitance

6.4– 64 V types: -10 to $+50\%$

100–500 V types: -10 to $+30\%$

Catalog number: 2222

Capacitors with soldering terminals

Single capacitors

can size	working voltage ($V_{a.c.}$)	capacitance (μF)	leakage current ¹⁾ (μA)	ripple current ²⁾ (mA)	dissipation factor ³⁾	impedance ⁴⁾ (Ω)	catalog number suffix
4	10	1250	400	600	0.30	0.63	063 14132
5	10	2000	630	850	0.30	0.40	202
6	10	3200	1000	1000	0.40	0.25	322
4	16	800	400	500	0.25	0.63	063 15801
6	16	2000	1000	1000	0.25	0.25	202
4	25	500	400	450	0.20	0.63	063 16501
5	25	800	600	650	0.20	0.40	801
6	25	1250	1000	850	0.20	0.25	132
5	40	500	600	650	0.15	0.40	063 17501
5	64	320	600	500	0.10	0.40	063 18321
6	64	500	1000	800	0.10	0.25	501
4	100	100	330	250	0.15	1.25	080 10101
6	100	250	780	450	0.15	0.63	251
4	150	64	330	200	0.15	1.5	080 11649
5	150	100	500	250	0.15	1.0	101
6	300	100	930	250	0.15	4.5	080 14101
4	350	32	360	100	0.15	2.8	080 15329
5	350	50	550	150	0.15		509
5	400	32	410	150	0.30	7.3	080 16329
6	400	50	630	200	0.30	4.55	509
5	500	25	400	100	0.30	10	080 18259
6	500	32	500	150	0.30	7.9	329

¹⁾ Maximum leakage current at 20°C after 5 minutes.

²⁾ Maximum permissible ripple current at 100 Hz and 70°C .

³⁾ Maximum dissipation factor ($\tan \delta$) at 20°C and 50 Hz.

⁴⁾ Maximum impedance at 20°C and 100 kHz.

ELECTROLYTIC CAPACITORS

Double capacitors

<i>can size</i>	<i>working voltage</i> ($V_{d.c.}$)	<i>capacitance</i> (μF)	<i>leakage current</i> ¹⁾ (μA)	<i>ripple current</i> ²⁾ (mA)	<i>dissipation factor</i> ³⁾	<i>impedance</i> ⁴⁾ (Ω)	<i>catalog number suffix</i>
4	25	250 + 250	2×200	2×225	0.20	2×1.25	064 16251
4	64	100 + 100	2×200	2×200	0.10	2×1.25	064 18101
3	100	25 + 25	2×100	2×50	0.15	2×5.0	081 10259
4	100	50 + 50	2×180	2×125	0.15	2×2.5	509
5	150	50 + 50	2×265	2×125	0.15	2×2.0	081 11509
6	300	50 + 50	2×500	2×125	0.15	2×2.5	081 14509
5	350	25 + 25	2×300	2×75	0.15	2×5.5	081 15259
6	350	32 + 32	2×360	2×100	0.15	2×4.5	081 18329
4	500	8 + 8	2×135	2×50	0.30	2×39	081 18808

Capacitors with twistable mounting lugs

Single capacitors

<i>can size</i>	<i>working voltage</i> ($V_{d.c.}$)	<i>capacitance</i> (μF)	<i>leakage current</i> ¹⁾ (μA)	<i>ripple current</i> ²⁾ (mA)	<i>dissipation factor</i> ³⁾	<i>impedance</i> ⁴⁾ (Ω)	<i>catalog number suffix</i>
7	25	2000	1500	1100	0.20	0.15	063 36202
8	25	2500	2000	1200	0.20	0.15	252
6T	40	800	1000	800	0.15	0.25	063 37801
7	40	1250	1500	1100	0.15	0.15	132
8	40	1600	2000	1200	0.15	0.15	162
8	64	1000	2000	1200	0.10	0.15	063 38102
6T	100	250	780	450	0.15	0.63	080 30251
8	150	500	2300	650	0.15	0.63	080 31501
8	300	250	2300	450	0.15	0.63	080 34251
9	350	250	2650	500	0.15	0.63	080 35251
7	400	100	1100	200	0.30	1.75	080 36101
8	450	100	1300	200	0.30	2.3	080 37101
7	500	50	780	200	0.30	6.5	080 38509
9	500	100	1500	300	0.30	3.25	101

Double capacitors

can size	working voltage ($V_{d.c.}$)	capacitance (μF)	leakage current ¹⁾ (μA)	ripple current ²⁾ (mA)	dissipation factor ³⁾	impedance ⁴⁾ (Ω)	catalog number suffix
6T	25	640 + 640	2 × 500	2 × 425	0.20	2 × 0.5	064 36641
6T	64	250 + 250	2 × 500	2 × 400	0.10	2 × 0.5	064 38251
8	64	500 + 500	2 × 1000	2 × 600	0.10	2 × 0.3	501
6T	100	125 + 125	2 × 400	2 × 225	0.15	2 × 1.25	081 30131
6T	150	125 + 125	2 × 650	2 × 225	0.15	2 × 1.25	081 31131
8	150	250 + 250	2 × 1150	2 × 325	0.15	2 × 1.25	251
6T	300	50 + 50	2 × 500	2 × 125	0.15	2 × 2.5	081 34509
8	300	125 + 125	2 × 1150	2 × 225	0.15	2 × 1.25	031
6T	350	32 + 32	2 × 360	2 × 100	0.15	2 × 4.5	081 35329
9	350	125 + 125	2 × 1350	2 × 250	0.15	2 × 1.25	131
6T	400	25 + 25	2 × 330	2 × 100	0.30	2 × 9.1	081 36259
7	400	50 + 50	2 × 630	2 × 100	0.30	2 × 4.55	509
8	450	50 + 50	2 × 700	2 × 100	0.30	2 × 4.55	081 37509
6T	500	16 + 16	2 × 270	2 × 75	0.30	2 × 20	081 38169
7	500	25 + 25	2 × 400	2 × 100	0.30	2 × 13	259
9	500	50 + 50	2 × 780	2 × 150	0.30	2 × 6.5	509

Capacitors for printed-wiring boards

Single capacitors

can size	working voltage ($V_{d.c.}$)	capacitance (μF)	leakage current ¹⁾ (μA)	ripple current ²⁾ (mA)	dissipation factor ³⁾	impedance ⁴⁾ (Ω)	catalog number suffix
5	10	2000	630	850	0.30	0.40	063 54202
4	16	800	400	500	0.25	0.63	063 55801
5	16	1250	600	700	0.25	0.40	132
6T	16	2000	1000	1000	0.25	0.25	063 55202
8A	16	3200	1500	1200	0.35	0.15	322
9A	16	4000	2000	1300	0.35	0.15	402
4	25	500	400	450	0.20	0.63	063 56501
5	25	800	600	650	0.20	0.40	801
6T	25	1250	1000	850	0.20	0.25	132
8A	25	2000	1500	1100	0.20	0.15	202

¹⁾ Maximum leakage current at 20°C after 5 minutes.

²⁾ Maximum permissible ripple current at 100 Hz and 70°C.

³⁾ Maximum dissipation factor ($\tan \delta$) at 20°C and 50 Hz.

⁴⁾ Maximum impedance at 20°C and 100 kHz.

ELECTROLYTIC CAPACITORS

can size	working voltage ($V_{d.c.}$)	capacitance (μF)	leakage current ¹⁾ (μA)	ripple current ²⁾ (mA)	dissipation factor ³⁾	impedance ⁴⁾ (Ω)	catalog number suffix
9A	25	2500	2000	1200	0.20	0.15	252
4	40	320	400	450	0.15	0.63	063 57321
5	40	500	600	650	0.15	0.40	501
6T	40	800	1000	800	0.15	0.25	801
8A	40	1250	1500	1100	0.15	0.15	132
9A	40	1600	2000	1200	0.15	0.15	162
5	64	320	600	500	0.10	0.40	063 58321
6T	64	500	1000	800	0.10	0.25	501
8A	64	800	1500	1100	0.10	0.15	801
9A	64	1000	2000	1200	0.10	0.15	102
4	150	64	330	200	0.15	1.5	080 51649
5	150	100	500	250	0.15	1.0	101
9A	200	250	1500	450	0.15	0.63	080 52251
6T	300	100	930	250	0.15	1.25	080 54101
4	350	32	360	100	0.15	4.5	080 55329
5	350	50	550	150	0.15	2.8	509
6T	400	50	630	200	0.30	4.55	080 56509
8A	450	64	900	200	0.30	3.65	080 57649
4	500	16	270	100	0.30	19.5	080 58169
8A	500	50	780	200	0.30	6.5	509

Double capacitors

can size	working voltage ($V_{d.c.}$)	capacitance (μF)	leakage current ¹⁾ (μA)	ripple current ²⁾ (mA)	dissipation factor ³⁾	impedance ⁴⁾ (Ω)	catalog number suffix
8A	25	1000 + 1000	2×780	2×550	0.20	2×0.3	064 56102
6T	64	250 + 250	2×500	2×400	0.10	2×0.5	064 58251
8A	64	400 + 400	2×750	2×550	0.10	2×0.3	401
6T	250	50 + 50	2×400	2×125	0.15	2×1.5	081 53509
6T	300	50 + 50	2×500	2×125	0.15	2×2.5	081 54509
5	350	25 + 25	2×300	2×75	0.15	2×5.5	081 55259
6T	350	32 + 32	2×360	2×100	0.15	2×4.5	329
8A	400	50 + 50	2×630	2×100	0.30	2×4.55	081 55509
6T	500	16 + 16	2×270	2×75	0.30	2×20	081 58169

¹⁾ Maximum leakage current at 20°C after 5 minutes.

²⁾ Maximum permissible ripple current at 100 Hz and 70°C.

³⁾ Maximum dissipation factor ($\tan \delta$) at 20°C and 50 Hz.

⁴⁾ Maximum impedance at 20°C and 100 kHz.

Multiple types for high voltages

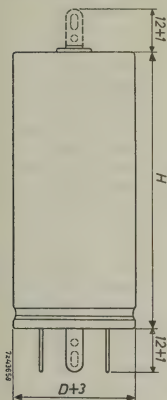


Fig. 1

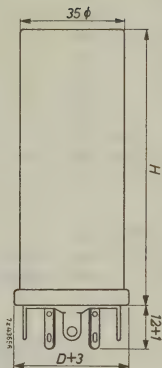


Fig. 2

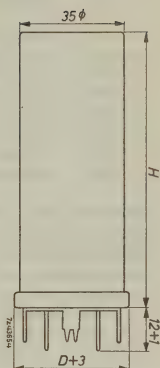


Fig. 3

capacitance (μF)	max. voltage ($V_{d.c.}$)	Fig.	D (mm)	H (mm)	cat. number 2222
50 + 50 + 50	350	2	35	80	063 90027
100 + 50 + 50	300	2	35	80	063 90022
100 + 100 + 50	300	2	35	80	067 90003
200 + 100 + 50 + 25	300	1	35	80	067 90012
200 + 100 + 50 + 25	300	2	35	80	067 90013
200 + 100 + 50 + 25	300	3	35	80	067 90014

ELECTROLYTIC CAPACITORS

Large long life type (I.E.C. type 1)

Fig.	can size	D (mm)	L (mm)	t (mm)
1	5	21.3	49.3	12
1	6	25.3	49.3	12
1	7	25.3	80.3	12
1	8a	30.3	50.3	12
1	8	30.3	80.3	12
2	9a	35.3	50.3	12
2	9	35.3	80.3	12
2	10	40.5	80.3	12

Temperature range: -40 to $+85^{\circ}\text{C}$

Tolerance on capacitance: -10 to $+50\%$

Catalogue numbers: 2222 071 , 2222 072 , 2222 073

Max (d.c. + peak a.c.) voltage at $\leq 40^{\circ}\text{C}$: $1.1 \times$ rated voltage

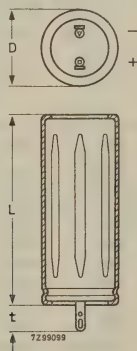


Fig. 1
(single)

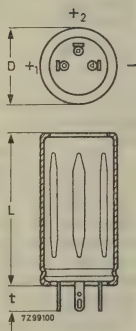


Fig. 2
(double)

can size	rated voltage (V)	capacitance (μF)	max. ripple current (A) ¹⁾		leakage current ²⁾ (μA) max.	$\tan \delta$ at 100 Hz max.	impedance at 100 kHz (m Ω) max.	catal. No. 2222 followed by
			50° C	85° C				
6	6.3	10000	4.0	1.8	380	0.50	60	071 13103
7	6.3	15000	6.1	2.7	570	0.50	50	071 13153
8a	6.3	15000	5.5	2.5	570	0.50	50	073 13153
8	6.3	22000	8.3	3.7	835	0.50	50	071 13223
9a	6.3	11000 + 11000	7.5	3.3	420 + 420	0.50	60 + 60	072 13113
9	6.3	16500 + 16500	11	4.9	625 + 625	0.50	50 + 50	072 13173
10	6.3	23500 + 23500	14.2	6.3	890 + 890	0.50	50 + 50	072 13243
5	10	4700	2.5	1.1	280	0.35	80	071 14472
6	10	6800	4.0	1.8	410	0.35	60	071 14682
7	10	10000	6.0	2.7	600	0.35	50	071 14103
8a	10	10000	5.4	2.4	600	0.35	50	073 14103
8	10	15000	8.2	3.7	900	0.35	50	071 14153
9a	10	7500 + 7500	7.3	3.3	450 + 450	0.35	60 + 60	072 14752
9	10	11000 + 11000	10.6	4.8	660 + 660	0.35	50 + 50	072 14113
10	10	16500 + 16500	13.4	6.0	990 + 990	0.35	50 + 50	072 14173
5	16	3300	2.4	1.1	320	0.25	80	071 15332
6	16	4700	3.9	1.7	450	0.25	60	071 15472
7	16	6800	5.8	2.6	655	0.25	50	071 15682
8a	16	6800	5.3	2.4	655	0.25	50	073 15682
8	16	10000	7.9	3.5	960	0.25	50	071 15103
9a	16	5000 + 5000	7.1	3.2	480 + 480	0.25	60 + 60	072 15502
9	16	7500 + 7500	10.5	4.7	720 + 720	0.25	50 + 50	072 15752
10	16	11000 + 11000	13.8	6.1	1060 + 1060	0.25	50 + 50	072 15113
5	25	2200	2.2	1.0	330	0.20	80	071 16222
6	25	3300	3.7	1.7	495	0.20	60	071 16332
7	25	4700	5.4	2.4	705	0.20	50	071 16472
8a	25	4700	4.9	2.2	750	0.20	50	073 16472
8	25	6800	7.3	3.3	1020	0.20	50	071 16682
9a	25	3400 + 3400	6.5	2.9	510 + 510	0.20	60 + 60	072 16342
9	25	5000 + 5000	9.6	4.3	750 + 750	0.20	50 + 50	072 16502
10	25	7500 + 7500	12.6	5.7	1125 + 1125	0.20	50 + 50	072 16752

Notes to the table:

¹⁾ Max. permissible r.m.s. values of ripple current, of any frequency and with the rated voltage applied, for single capacitors and for paralleled double capacitors. When both sections of a double capacitor carry ripple current, $\frac{1}{2} \times$ stated limits apply to each section; when only one section carries ripple current, $\frac{1}{2}\sqrt{2} \times$ stated limits apply.

²⁾ Leakage current 5 min after application of the rated voltage.

ELECTROLYTIC CAPACITORS

can size	rated voltage (V)	capacitance (μF)	max. ripple current (A) ¹⁾		leakage current ²⁾ (μA) max.	tan δ at 100 Hz max.	impedance at 100 kHz (mΩ) max.	catal. No. 2222 followed by
			50° C	85° C				
5	40	1000	2.1	1.0	240	0.15	125	071 17102
6	40	2200	2.9	1.3	530	0.15	100	071 17222
7	40	3300	5.2	2.4	795	0.15	80	071 17332
8a	40	3300	3.8	1.7	795	0.15	80	073 17332
8	40	4700	7.0	3.1	1130	0.15	80	071 17472
9a	40	2350 + 2350	5.3	2.4	560 + 560	0.15	100 + 100	072 17242
9	40	3400 + 3400	9.1	4.1	820 + 820	0.15	80 + 80	072 17342
10	40	5000 + 5000	12.0	5.3	1200 + 1200	0.15	80 + 80	072 17502
5	63	680	2.1	0.8	260	0.10	125	071 18681
6	63	1000	2.9	1.3	380	0.10	100	071 18102
7	63	1500	4.3	2.0	570	0.10	80	071 18152
8a	63	1500	3.8	1.7	570	0.10	80	073 18152
8	63	2200	5.8	2.6	835	0.10	80	071 18222
9a	63	1100 + 1100	5.3	2.4	415 + 415	0.10	100 + 100	072 18112
9	63	1650 + 1650	7.8	3.5	625 + 625	0.10	80 + 80	072 18172
10	63	2350 + 2350	10	4.5	890 + 890	0.10	80 + 80	072 18242

Notes to the table:

¹⁾ Max. permissible r.m.s. values of ripple current, of any frequency and with the rated voltage applied, for single capacitors and for paralleled double capacitors. When both sections of a double capacitor carry ripple current, $\frac{1}{2} \times$ stated limits apply to each section; when only one section carries ripple current, $\frac{1}{2}\sqrt{2} \times$ stated limits apply.

²⁾ Leakage current 5 min after application of the rated voltage.

Mounting clamps for 071, 072 and 073 series

can size	catalog number
5	4322 043 03290
6, 7	03300
8, 8a	03310
9, 9a	04272
10	03330

Small long life type

can size	axial version		printed-wiring version		
	<i>D</i> (mm)	<i>L</i> (mm)	<i>D</i> (mm)	<i>L</i> (mm)	<i>S</i> (mm)
1	8.3	22.5	11.3	30	10.16
2	10.5	22.5	12.9	31	10.16
3	10.5	30.5	12.9	39	10.16
4	13	30.5	15.3	39	10.16

Temperature range: -40 to +70°C

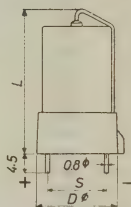
Tolerance on capacitance: -10 to +50%

Catalog number: 2222 101 1, axial version

2222 101 4, printed-wiring version



Axial version



Printed-wiring version

can size	working voltage (<i>V_{a.c.}</i>)	capacitance (μ F)	leakage current ¹⁾ (μ A)	ripple current ²⁾ (mA)	dissipation factor ³⁾	impedance ⁴⁾ (Ω)	catalog number suffix
1	4	25	6	20	0.20	6	2259
1	4	50	7	40	0.30	6	2509
2	4	80	8	55	0.30	4	2809
3	4	160	11.5	90	0.30	2	2161
4	4	320	18	145	0.30	1	2321
1	6.4	20	6.5	25	0.20	6	3209
1	6.4	40	7.5	40	0.25	6	3409
2	6.4	64	9	55	0.25	4	3649
3	6.4	125	13	90	0.25	2	3131
4	6.4	250	21	145	0.25	1	3251
1	10	16	6.5	25	0.15	6	4169
1	10	32	8	40	0.20	6	4329
2	10	50	10	55	0.20	4	4509
3	10	100	15	90	0.20	2	4101
4	10	200	25	145	0.20	1	4201
1	16	10	6.5	25	0.15	6	5109
1	16	20	8	40	0.15	6	5209
2	16	32	10	55	0.15	4	5329
3	16	64	15.5	90	0.15	2	5649

ELECTROLYTIC CAPACITORS

<i>can size</i>	<i>working voltage ($V_{d.c.}$)</i>	<i>capac- itance (μF)</i>	<i>leakage current¹⁾ (μA)</i>	<i>ripple current²⁾ (mA)</i>	<i>dissi- pation factor³⁾</i>	<i>impe- dance⁴⁾ (Ω)</i>	<i>catalog number suffix</i>
4	16	125	25	145	0.15	1	5131
1	25	6.4	6.5	25	0.10	6	6648
1	25	12.5	8	40	0.10	6	6139
2	25	20	10	55	0.10	4	6209
3	25	40	15	90	0.10	2	6409
4	25	80	25	145	0.10	1	6809
1	40	4	6.5	15	0.10	6	7408
1	40	8	8	25	0.10	6	7808
2	40	12.5	10	35	0.10	4	7139
3	40	25	15	55	0.10	2	7259
4	40	50	25	90	0.10	1	7509
1	64	2.5	6.5	15	0.10	6	8258
1	64	5	8	25	0.10	6	8508
2	64	8	10	35	0.10	4	8808
3	64	16	15.5	55	0.10	2	8169
4	64	32	25.5	90	0.10	1	8329

¹⁾ Maximum leakage current at 20°C after 5 minutes.

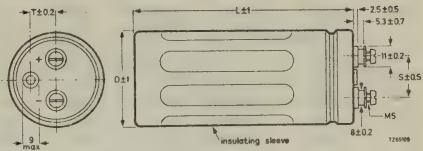
²⁾ Maximum permissible ripple current at 100 Hz and 70°C.

³⁾ Maximum dissipation factor ($\tan \delta$) at 20°C and 50 Hz.

⁴⁾ Maximum impedance at 20°C and 100 kHz.

Large long life type (I.E.C. type 1)

can size	$D_{\max.}$ (mm)	L (mm)	S (mm)
11	35.8	82	15
12	35.8	114	15
14	50.8	82	22
15	50.8	114	22
16	65.8	114	31



Temperature range: -40 to $+70^{\circ}\text{C}$

Tolerance on capacitance: -10 to $+50\%$

Catalog number: 2222 106 , working voltage 6.3 to 63 $\text{V}_{\text{d.c.}}$
2222 107 , working voltage 100 $\text{V}_{\text{d.c.}}$

Mounting clamps for 106 and 107 series

For cans with 35 mm dia.: 4322 043 04271
50 mm dia.: 04280
65 mm dia.: 04290

ELECTROLYTIC CAPACITORS

can size	rated voltage (V)	capacitance (μ F)	leakage current ¹⁾ (mA)	ripple current (A) ²⁾		tan δ at 100 Hz max.	cat. number 2222 followed by
				50°C	85°C		
11	6.3	22000	0.9	7	3.1	0.45	106 13223
12	6.3	33000	1.3	10	4.5	0.55	106 13333
14	6.3	47000	1.8	12	5.4	0.60	106 13473
15	6.3	68000	2.6	17	7.7	0.70	106 13683
16	6.3	150000	5.7	28	12.6	1.0	106 13154
11	10	15000	0.9	7	3.1	0.30	106 14153
12	10	22000	1.4	10	4.5	0.35	106 14223
14	10	33000	2.0	12	5.4	0.40	106 14333
15	10	47000	2.9	17	7.7	0.45	106 14473
16	10	100000	6.0	28	12.6	0.70	106 14104
11	16	10000	1.0	7	3.1	0.20	106 15103
12	16	15000	1.5	10	4.5	0.25	106 15153
14	16	22000	2.2	12	5.4	0.25	106 15223
15	16	3300	3.2	17	7.7	0.30	106 15333
16	16	68000	6.6	28	12.6	0.45	106 15683
11	25	6800	1.1	7	3.1	0.15	106 16682
12	25	10000	1.5	10	4.5	0.16	106 16103
14	25	15000	2.3	12	5.4	0.19	106 16153
15	25	22000	3.3	17	7.7	0.20	106 16223
16	25	47000	7.1	28	12.6	0.32	106 16473
11	40	4700	1.2	7	3.1	0.10	106 17472
12	40	6800	1.7	10	4.5	0.11	106 17682
14	40	10000	2.4	12	5.4	0.12	106 17103
15	40	15000	3.6	17	7.7	0.14	106 17153
16	40	33000	8.0	28	12.6	0.20	106 17333
11	63	2200	0.9	7	3.1	0.050	106 18222
12	63	3300	1.3	10	4.5	0.055	106 18332
14	63	4700	1.8	12	5.4	0.050	106 18472
15	63	6800	2.6	17	7.7	0.060	106 18682
16	63	15000	5.7	28	12.6	0.100	106 18153
11	100	1500	0.9	7	3.1	0.40	107 10152
12	100	2200	1.4	10	4.5	0.40	107 10222
14	100	3300	2.0	12	5.4	0.40	107 10332
15	100	4700	2.9	17	7.7	0.40	107 10472
16	100	10000	6.0	28	12.6	0.40	107 10103

¹⁾ Max. leakage current at 20°C after 5 minutes. ²⁾ Max. permissible ripple current at 100 Hz.

³⁾ For capacitors provided with bolt and nut the 8th digit in the catalog number is 5 instead of 1.

Note: Mounting position not with terminals down.

Solid aluminium type

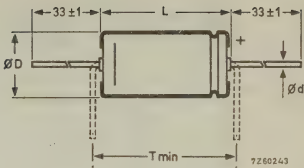
case size	D_{max} (mm)	L^{-1} (mm)	T_{min}^{-1}
1	6.6	17.5	8e
2	6.6	24	11e
3	8.3	24	11e
4	10.4	24	11e
5	10.4	32	14e
6	12.9	32	14e

$c = 2.50 + 0.04 \text{ mm}$

Temperature range -55 to $+85^{\circ}\text{C}$

Tolerance on capacitance $\pm 20\%$

Catalog number 2222 121



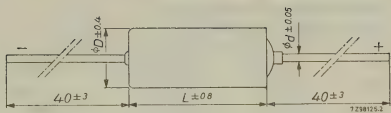
ELECTROLYTIC CAPACITORS

case size	rated voltage ($V_{d.c.}$)	capacitance itance (μF)	leakage current ¹⁾ (μA)	ripple current ²⁾ (mA)	dissi- pation factor ³⁾	impe- dance ⁴⁾ (Ω)	catalog number suffix
1	6.3	22	12.5	90	0.18	2.5	13229
2	6.3	47	25	150	0.18	1.25	13479
3	6.3	68	40	205	0.18	0.75	13689
4	6.3	150	70	340	0.18	0.5	13151
5	6.3	220	125	480	0.18	0.4	13221
6	6.3	330	150	670	0.18	0.4	13331
1	10	15	15	80	0.16	2.5	14159
2	10	33	30	135	0.16	1.25	14339
3	10	47	50	175	0.16	0.75	14479
4	10	100	80	290	0.16	0.5	14101
5	10	150	150	430	0.16	0.4	14151
6	10	220	200	575	0.16	0.4	14221
1	16	10	20	70	0.14	2.5	15109
2	16	15	40	95	0.14	1.25	15159
3	16	33	75	195	0.14	0.75	15339
4	16	47	100	215	0.14	0.5	15479
5	16	68	175	300	0.14	0.4	15689
6	16	100	250	410	0.14	0.4	15101
1	25	4.7	20	45	0.14	5	16478
2	25	10	40	80	0.14	2.5	16109
3	25	22	75	140	0.14	1.5	16229
4	25	33	100	180	0.14	1	16339
5	25	47	175	255	0.44	0.8	16479
6	25	68	250	340	0.14	0.5	16689
1	40	2.2	20	40	0.12	5	17228
2	40	4.7	40	65	0.12	2.5	17478
3	40	10	75	105	0.12	1.5	17109
4	40	22	100	175	0.12	1	17229
5	40	33	175	245	0.12	0.8	17339
6	40	47	250	325	0.12	0.5	17479

1) Maximum leakage current at 20°C after 5 minutes. 2) Maximum permissible ripple current at 100 Hz and 70°C. 3) Maximum dissipation factor ($\tan \delta$) at 20°C and 100 Hz. 4) Maximum impedance at 20°C and 100 kHz.

Solid tantalum type

case size	<i>D</i> (mm)	<i>L</i> (mm)	<i>d</i> (mm)
1	3.43	7.26	0.51
2	4.75	12.04	0.51
3	7.34	17.42	0.64
4	8.92	19.96	0.64



ELECTROLYTIC CAPACITORS

Temperature range: -55 to $+85^{\circ}\text{C}$

Tolerance on capacitance: $\pm 20\%$

Catalog number: 2222 143

<i>can size</i>	<i>d.c. rated voltage at 85°C (V)</i>	<i>capacitance (μF)</i>	<i>leakage current¹⁾ (μA)</i>	<i>catalog number suffix</i>
1	6	5.6	1	13568
1	6	6.8	1	13688
2	6	47	6	13479
2	6	56	7	13569
3	6	150	18	13151
3	6	180	21	13181
4	6	270	32	13271
4	6	330	40	13331
1	10	3.9	1	14398
1	10	4.7	1	14478
2	10	27	5	14279
2	10	33	7	14339
2	10	39	8	14399
3	10	82	16	14829
3	10	100	20	14101
3	10	120	24	14121
4	10	180	36	14181
4	10	220	44	14221
1	15	2.7	1	15278
1	15	3.3	1	15338
2	15	18	5	15189
2	15	22	7	15229
3	15	56	17	15569
3	15	68	20	15689
4	15	120	36	15121
4	15	150	45	15151
1	20	1.2	1	16128
1	20	1.5	1	16158
1	20	1.8	1	16188
1	20	2.2	1	16228
2	20	8.2	3	16828
2	20	10	4	16109

<i>can size</i>	<i>d.c. rated voltage at 85°C (V)</i>	<i>capacitance (μF)</i>	<i>leakage current¹⁾ (μA)</i>	<i>catalog number suffix</i>
2	20	12	5	16129
2	20	15	6	16159
3	20	27	11	16279
3	20	33	13	16339
3	20	39	16	16399
3	20	47	19	16479
4	20	56	22	16569
4	20	68	27	16689
4	20	82	33	16829
4	20	100	40	16101
1	35	0.33	1	17337
1	35	0.39	1	17397
1	35	0.47	1	17477
1	35	0.56	1	17567
1	35	0.68	1	17687
1	35	0.82	1	17827
1	35	1	1	17108
2	35	1.2	1	17128
2	35	1.5	1	17158
2	35	1.8	1	17188
2	35	2.2	2	17228
2	35	2.7	2	17278
2	35	3.3	2	17338
2	35	3.9	3	17398
2	35	4.7	3	17478
2	35	5.6	4	17568
2	35	6.8	5	17688
3	35	8.2	6	17828
3	35	10	7	17109
3	35	12	8	17129
3	35	15	11	17159
3	35	18	13	17189
3	35	22	15	17229
4	35	27	19	17279
4	35	33	23	17339
4	35	39	27	17399
4	35	47	33	17479

¹⁾ Maximum leakage current at 25°C after 5 minutes.

ELECTROLYTIC CAPACITORS

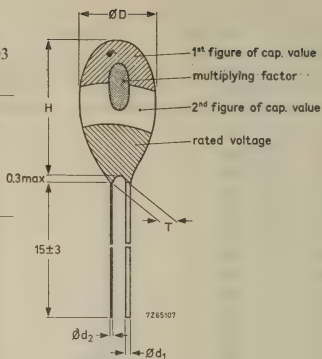
Solid tantalum type

Size	D_{max} (mm)	H_{max} (mm)	$T \pm 0.3$ (mm)	$d_1 \pm 0.05$ (mm)	$d_2 \pm 0.03$ (mm)
DTM1	2	2.7	1	0.3	0.2
DTM2	2	4	1	0.3	0.2
DTM3	2.5	4.2	1	0.3	0.2
DTM4	3.2	4.5	1.1	0.3	0.2
DTM5	4	7.5	1.2	0.3	0.2

Temperature range -55 to $+85^{\circ}\text{C}$

Tolerance on capacitance $\pm 20\%$

Catalog number 2222 146



colour	capacitance (μF)		multiplying factor (spot)	rated voltage (V) (third band)
	1st figure (first band)	2nd figure (second band)		
black	—	0	1	10
brown	1	1	10	1.6
red	2	2	10^2	4
orange	3	3		40
yellow	4	4		6.3
green	5	5		16
blue	6	6		—
violet	7	7	10^{-3}	
grey	8	8	10^{-2}	25
white	9	9	10^{-1}	2.5

rated voltage (V)	nom. cap. at 100 Hz (μF) (μF)	max. ripple current at 100 Hz up to 70° C (mA)	max. leakage current after 5 min. (μA)	max. tan δ at 100 Hz	max. impedance at 100 kHz (Ω)	size	cat. number 2222 146
1.6	1.5	5	0.5	0.15	25	1	10158
1.6	2.2	6	0.5	0.15	25	1	10228
1.6	3.3	9	1	0.15	15	2	10338
1.6	4.7	10	1	0.15	15	2	10478
1.6	6.8	15	1	0.15	7.5	3	10688
1.6	10	18	1	0.15	7.5	3	10109
1.6	15	25	1.5	0.15	5	4	10159
1.6	22	30	1.3	0.15	5	4	10229
1.6	47	65	2.5	0.15	3	5	10479
1.6	68	80	2.5	0.15	3	5	10689
2.5	1	5	0.5	0.10	30	1	11108
2.5	2.2	9	1	0.10	15	2	11228
2.5	4.7	15	1	0.10	7.5	3	11478
2.5	10	25	1.5	0.10	5	4	11109
2.5	33	65	2.5	0.10	3	5	11339
4	0.68	4	0.5	0.10	35	1	12687
4	1.5	7	1	0.10	20	2	12158
4	3.3	13	1	0.10	7.5	3	12338
4	6.8	20	1.5	0.10	5	4	12688
4	22	55	2.5	0.10	3	5	12229
6.3	0.47	4	0.5	0.08	35	1	13477
6.3	1	7	1	0.08	20	2	13108
6.3	2.2	13	1	0.08	7.5	3	13228
6.3	4.7	20	1.5	0.08	5	4	13478
6.3	15	55	2.5	0.08	3	5	13159
10	0.33	3	0.5	0.08	40	1	14337
10	0.68	5	1	0.08	25	2	14687
10	1.5	10	1	0.08	7.5	3	14158
10	3.3	15	1.5	0.08	5	4	14338
10	10	40	2.5	0.08	3	5	14109
16	0.22	2	0.5	0.08	40	1	15227
16	0.47	4	1	0.08	25	2	15477
16	1	7	1	0.08	7.5	3	15108
16	2.2	10	1.5	0.08	5	4	15228
16	6.8	30	2.5	0.08	3	5	15688
25	0.15	2	0.5	0.08	50	1	16157
25	0.33	4	1	0.08	30	2	16337

ELECTROLYTIC CAPACITORS

<i>rated voltage (V)</i>	<i>nom. cap. at 100 Hz (μF)</i>	<i>max. ripple current at 100 Hz up to 70°C (mA)</i>	<i>max. leakage current after 5 min. (μA)</i>	<i>max. $\tan \delta$ at 100 Hz</i>	<i>max. impedance at 100 kHz (Ω)</i>	<i>size</i>	<i>cat. number 2222 146</i>
25	0.68	7	1	0.08	10	3	16687
25	1.5	10	1.5	0.08	7.5	4	16158
25	4.7	30	2.5	0.08	3.5	5	16478
40	0.01	0.5	0.5	0.08	225	1	17106
40	0.015	0.7	0.5	0.08	200	1	17156
40	0.022	0.8	0.5	0.08	150	1	17226
40	0.033	1	0.5	0.08	125	1	17336
40	0.047	1.2	0.5	0.08	100	1	17476
40	0.068	1.5	0.5	0.08	75	1	17686
40	0.1	1.7	0.5	0.08	60	1	17107
40	0.15	2.5	1	0.08	35	2	17157
40	0.22	3	1	0.08	35	2	17227
40	0.33	4	1	0.08	20	3	17337
40	0.47	5	1	0.08	15	3	17477
40	0.68	7	1.5	0.08	10	4	17687
40	1	9	1.5	0.08	7.5	4	17108
40	1.5	15	2.5	0.08	5	5	17158
40	2.2	20	2.5	0.08	4	5	17228
40	3.3	25	2.5	0.08	3.5	5	17338

VARIABLE CAPACITORS

Tubular ceramic trimmers

Temperature range: -50 to $+100^{\circ}\text{C}$

Temperature coefficient: (-200 ± 200)

$10^{-6}/\text{deg C}$

Maximum working voltage: $500 V_{\text{d.c.}}$

Min. parallel damping at 1.5 MHz : $3 \text{ M}\Omega$

Soldering: 260°C , 4 s

Operating torque: $0.4\text{--}5 \text{ N cm}$

cap. swing	zero cap.	dimensions	Fig.	cat. number
(pF)	(pF)	(mm)		2222 801

		L	A		
≥ 3	≤ 0.8	5.5	13.5	1	20001
≥ 6	≤ 0.8	8.5	16.5	1	20002
≥ 9	≤ 0.9	11.5	19.5	1	20003
≥ 12	≤ 1	14.5	22.5	1	20004
≥ 3	≤ 0.8	5.5	13.5	2	20005
≥ 6	≤ 0.8	8.5	16.5	2	20006
≥ 9	≤ 0.9	11.5	19.5	2	20007
≥ 12	≤ 1	14.5	22.5	2	20008

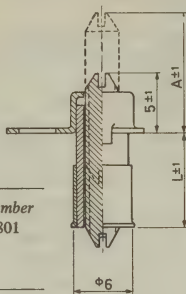


Fig. 1

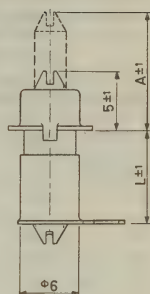


Fig. 2

Temperature range: -50 to $+180^{\circ}\text{C}$

Max. working voltage: $400 V_{\text{d.c.}}$

Min. parallel damping at 1.0 MHz : $3 \text{ M}\Omega$

Soldering:

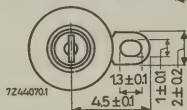
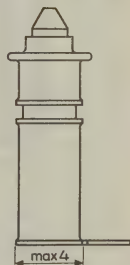
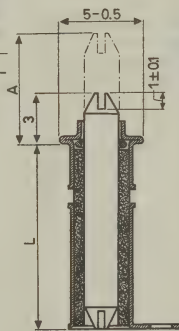
stator tag: in conformity with I.E.C. 68,
test T

cap: the soldering temperature must
lie between 240°C and 260°C ,
maximum soldering time is 10 s .

Operating torque: $0.1\text{--}2 \text{ N cm}$

cap. swing	zero cap.	temp. coeff.	dimensions	cat. number
(pF)	(pF)	$10^{-6}/\text{deg C}$	(mm)	2222 801

			L	A	
≥ 3	≤ 0.8	-200 ± 200	7.8	10.5	20051
≥ 6	≤ 0.8	-300 ± 200	10.8	13.5	20052



VARIABLE CAPACITORS

Temperature range: -50 to $+100^{\circ}\text{C}$

Temperature coefficient:

trimmers 2222 801 96003: $(150 \pm 150) 10^{-6}/\text{deg C}$

2222 801 96002: $(150 \pm 100) 10^{-6}/\text{deg C}$

Max. working voltage: $500 V_{\text{d.c.}}$

Min. parallel damping at 1.0 MHz : $10 \text{ M}\Omega$

Soldering: 250°C , 4 s

Operating torque: $0.4\text{--}5 \text{ Ncm}$

cap. swing (pF)	zero cap. (pF)	Fig.	catalog number
≥ 3	≤ 0.5	1	2222 801 96003
≥ 6	≤ 0.7	2	96002

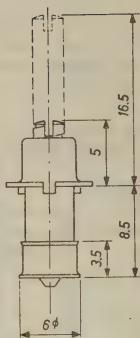


Fig. 1

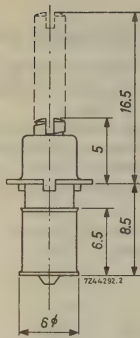


Fig. 2

Temperature range: -50 to $+100^{\circ}\text{C}$

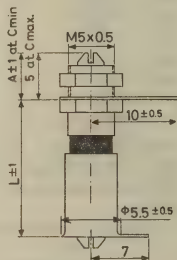
Temperature coefficient: $(-200 \pm 200) 10^{-6}/\text{deg C}$

Max. working voltage: $500 V_{\text{d.c.}}$

Min. parallel damping at 1.0 MHz : $3 \text{ M}\Omega$

Operating torque: $0.4\text{--}5 \text{ Ncm}$

cap. swing (pF)	zero cap. (pF)	dimensions (mm)		catalog number
		L	A	
≥ 3	≤ 0.8	11	14.5	2222 802 20001
≥ 6	≤ 0.8	14	17.5	20002
≥ 9	≤ 0.9	17	20.5	20003
≥ 12	≤ 1.0	20	23.5	20004
≥ 18	≤ 1.7	20	23.5	20005



Temperature range: -50 to $+100^{\circ}\text{C}$

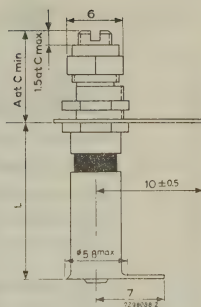
Max. working voltage: $500\text{ V}_{\text{d.c.}}$

Min. parallel damping at

1.0 MHz : $10\text{ M}\Omega$

Operating torque: $0.4\text{--}4\text{ Ncm}$

cap. swing (pF)	zero cap. (pF)	temp. coeff. ($10^{-6}/\text{deg C}$)	dimensions (mm)		catalog number
			L	A	
≥ 3	≤ 0.5	-10 ± 60	12.4	22.5	2222 802 20011
≥ 4.5	≤ 0.6	-10 ± 60	15.4	25.5	20012
≥ 6	≤ 0.7	-10 ± 60	17.9	28.0	20013
≥ 9	≤ 0.9	-250 ± 250	15.4	25.5	20014
≥ 12	≤ 1.0	-250 ± 250	18.4	28.0	20015



Temperature range: -50 to $+100^{\circ}\text{C}$

Temperature coefficient:

trimmers 2222 802 96035: $(-200 \pm 200) 10^{-6}/\text{deg C}$

2222 802 96036: $(-300 \pm 200) 10^{-6}/\text{deg C}$

Max. working voltage: $400\text{ V}_{\text{d.c.}}$

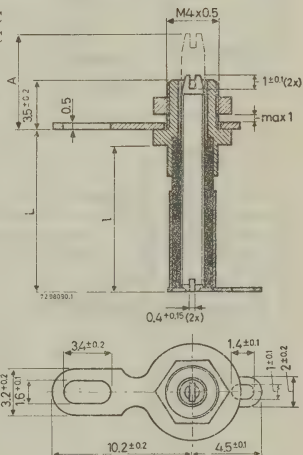
Min. parallel damping

at 1.0 MHz : $10\text{ M}\Omega$

Operating torque: $0.1\text{--}2\text{ Ncm}$

Catalog number: 2222 802

cap. swing (pF)	zero cap. (pF)	dimensions (mm)			catalog number suffix
		L	l	A	
≥ 3	≤ 0.8	8.3	7.3	9	96035
≥ 6	≤ 0.8	11.3	10.3	12	96036



VARIABLE CAPACITORS

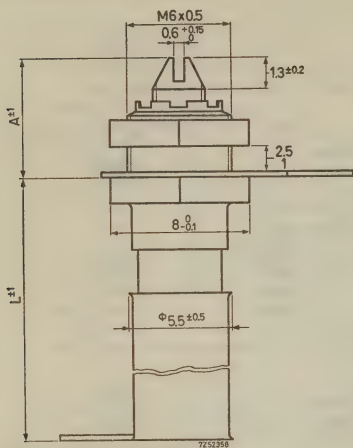


Fig. 1

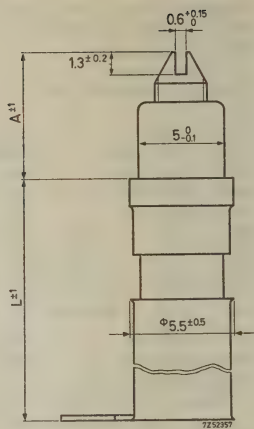


Fig. 2

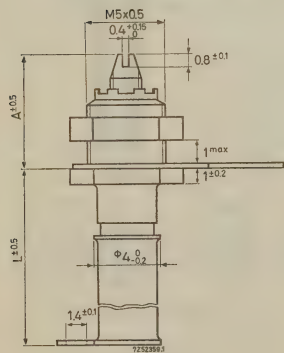


Fig. 3

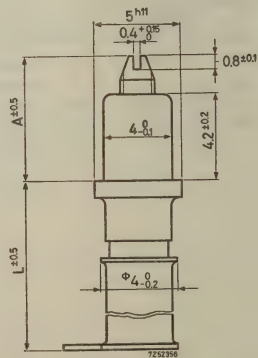


Fig. 4

These trimmers are available with a low dielectric constant (class A types) and with a high dielectric constant (class B types).

Temperature range: -50 to $+100^{\circ}\text{C}$

Temperature coefficient

class A types: $(-10 \pm 60) 10^{-6}/\text{deg C}$

class B types: $(-200 \pm 150) 10^{-6}/\text{deg C}$

Max. working voltage

class A types (according Figs. 1 and 2): $500 V_{d.c.}$

class B types (according Figs. 1 and 2): $500 V_{d.c.}$

class B types (according Figs. 3 and 4): $400 V_{d.c.}$

Min. parallel damping at 1.5 MHz : $10 \text{ M}\Omega$

class A types: $10 \text{ M}\Omega$

class B types: $3 \text{ M}\Omega$

Soldering temperature 350°C , 3s

cap. swing (pF)	zero cap. (pF)	class	dimensions (mm) see Figs. 1 and 2		catalog number 2222 802 960 . .	
			<i>L</i>	<i>A</i> at C_{\min}	Fig. 1	Fig. 2
≥ 3	≤ 0.8	B	11	14.5	44	51
≥ 6	≤ 0.8		14	17.5	45	52
≥ 9	≤ 0.9		17	20.5	46	53
≥ 12	≤ 1.0		20	23.5	47	54
≥ 3	≤ 0.5	A	14	14	66	69
≥ 4.5	≤ 0.6		17	17	67	71
≥ 6	≤ 0.7		19	20	68	72

cap. swing (pF)	zero cap. (pF)	class	dimensions (mm) see Figs. 3 and 4		catalog number 2222 802 960 . .	
			<i>L</i>	<i>A</i> at C_{\min}	Fig. 3	Fig. 4
≥ 3	≤ 0.8	B	8.8	7.8	55	57
≥ 6	≤ 0.8		11.8	10.8	56	58

VARIABLE CAPACITORS

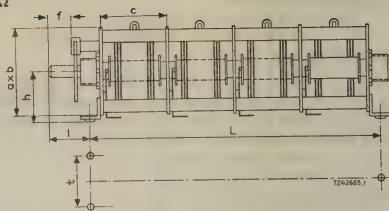
Precision tuning capacitors

Temperature range: -40 to $+85^{\circ}\text{C}$

Min. parallel damping at 1.5 MHz: $10\text{ M}\Omega$

Law and ganging tolerances: $\pm 0.7\%$

temp. coeff. ($10^{-6}/\text{deg C}$)		number of gangs
$a \times b =$	$a \times b =$	
$40 \times 40\text{ mm}$	$60 \times 60\text{ mm}$	
20 ± 20	30 ± 30	1
20 ± 20	30 ± 30	2
30 ± 30	50 ± 50	3
50 ± 50	50 ± 50	4



dimensions in mm

$a \times b$

number of gangs

			1	2	3	4
distance between mounting holes (± 0.5)	L	40×40	45	76.5	108	139.5
		60×60	67	117.5	168	218.5
	t	40×40			22	
		60×60			35	
compartment length (± 0.2)	c	40×40			31.5	
		60×60			50.5	
spindle length (± 0.5)	i	40×40			16	
		60×60			18	
spindle height (± 0.5)	h	40×40			22.5	
		60×60			32.5	
free spindle length	f	40×40			10	
		60×40			14.5	

size $a \times b = 40 \times 40$ mm linear capacitance law				size $a \times b = 60 \times 60$ mm linear capacitance law				size $a \times b = 60 \times 60$ mm logarithmic capacitance law			
single-stator or differential type		split-stator type	single-stator type	split-stator type	single-stator type		split-stator type	single-stator type		split-stator type	
C_{var} (pF)	$C_0 \pm 1$ pF ¹⁾ (pF)	V_{test} ²⁾ (V d.c.)	$C_0 \pm 1$ pF (pF)	V_{test} ³⁾ (V d.c.)	$C_0 \pm 1$ pF (pF)	V_{test} ³⁾ (V d.c.)	$C_0 \pm 1$ pF (pF)	V_{test} ³⁾ (V d.c.)	$C_0 \pm 1$ pF (pF)	V_{test} ³⁾ (V d.c.)	$C_0 \pm 1$ pF (pF)
10			3	3000							
16	8	2500	3.6	2000							
25	8.5	2000	4	2000							
32					5	4000			5	2500	
40	9	1500	4	1600	5	3000			5.5	2000	
50					5	2500			5.5	2000	
64	9	1000	4	1300	5.5	2000			5.5	1600	
80					5.5	2000			5.5	1600	
100	10	1000			14.5	2000	13	1500	5.5	1600	
125					15	2000	13	1250	5.5	1300	
160	11	800			15.5	1500	1	100	6		
200					16	1250					
200	11.5	650 ⁴⁾			16	1250					
320					17.5	1000					
400					19	1000					
500					20.5	1000					
640					21.5	800					

1) For the differential version the C_0 values are 1 pF less than the tabulated values, 2) Between rotor and stator, 3) Between the two stators,

4) Differential type only up to and including $C_{var} = 160$ pF

VARIABLE CAPACITORS

Catalogue numbers 2222 805

suffix, see Tables below

00 for 40 × 40 mm versions

02 for 60 × 60 mm versions

40 × 40 mm version

type	C_{var} (pF)	single-stator		split-stator	differential type	
		indirect drive ¹⁾	direct drive ²⁾	indirect drive ¹⁾	indirect drive ¹⁾	direct drive ²⁾
1 gang	10			187		
	16	131	173	188		
	25	132	178	189		
	40	133	174	191		
	64	134	175	192	239	252
	100	135	176		241	253
	160	136	177		242	254
	250	137	179			
2 gangs	2 × 10			194		
	2 × 16	138		195		
	2 × 25	139		196		
	2 × 40	141		197		
	2 × 64	142		198		
	2 × 100	143				
	2 × 160	144				
	2 × 250	145				
3 gangs	3 × 10					
	3 × 16	146		201		
	3 × 25	147		202		
	3 × 40	148		203		
	3 × 64	149		204		
	3 × 100	151		205		
	3 × 160	152				
	3 × 250	153				
4 gangs	4 × 10			207		
	4 × 16	154		208		
	4 × 25	155		209		
	4 × 40	156		211		
	4 × 64	157	212			
	4 × 100	158				
	4 × 160	159				
	4 × 250	161				

¹⁾ low torque ²⁾ high torque

60 × 60 mm version

type	C_{var} (pF)	single-stator		split-stator	
		linear law	logarithmic law	linear law	logarithmic law
1 gang	25			298	345
	32			299	346
	40			301	347
	50			302	348
	64			303	349
	80			304	351
	100	196	249	305	352
	125	197	251	306	353
	160	198	252		
	200	199	253		
	250	201	254		
	320	202	255		
	400	203	256		
	500	204	257		
	640	205			
2 gangs	2 × 25			307	354
	2 × 32			308	355
	2 × 40			309	356
	2 × 50			311	357
	2 × 64			312	358
	2 × 80			313	359
	2 × 100	206	258	314	361
	2 × 125	207	259	315	362
	2 × 160	208	261		
	2 × 200	209	262		
	2 × 250	211	263		
	2 × 320	212	264		
	2 × 400	213	265		
	2 × 500	214	266		
	2 × 640	215			

VARIABLE CAPACITORS

Catalogue numbers 2222 805 00 . . .

— suffix, see Tables II and III

60 × 60 mm version continued

type	C_{var} (pF)	single-stator		split-stator	
		linear law	logarithmic law	linear law	logarithmic law
3 gangs	3 × 25			316	363
	3 × 32			317	364
	3 × 40			318	365
	3 × 50			319	366
	3 × 64			321	367
	3 × 80			322	368
	3 × 100	216	267	323	369
	3 × 125	217	268	324	371
	3 × 160	218	269		
	3 × 200	219	271		
	3 × 250	221	272		
	3 × 320	222	273		
	3 × 400	223	274		
	3 × 500	224	275		
	3 × 640	225			
4 gangs	4 × 25			325	372
	4 × 32			326	373
	4 × 40			327	374
	4 × 50			328	375
	4 × 64			329	376
	4 × 80			331	377
	4 × 100	226	276	332	378
	4 × 125	227	277	333	379
	4 × 160	228	278		
	4 × 200	229	279		
	4 × 250	231	281		
	4 × 320	232	282		
	4 × 400	233	283		
	4 × 500	234	284		
	4 × 640	235			

Film dielectric trimmers

Temperature range: -40 to +70°C

Rated voltage: 100 V d.c.

	max. cap. (pF)	min. cap. (pF)	temp. coeff. (10 ⁻⁶ /deg C)	par. damping at 1.0 MHz (MΩ)	operating torque (Ncm)	Fig.	catalog number	
							top adjustment	top and bottom adjustment
rotor tags over 90°	≥ 3.5	≤ 1.2	-550 ± 250	> 10	0.1-1.5	1	00014	00011 ¹⁾
	≥ 5.5	≤ 1.4	-750 ± 300	> 10	0.1-1.5	1	00004	00012 ¹⁾
	≥ 10	≤ 2	-200 ± 300	> 3	0.1-1.5	1	00005	00013 ¹⁾
	≥ 22	≤ 2	-350 ± 250	> 3	0.1-1.5	1	00006	91504
	≥ 40	≤ 5.5	-400 ± 300	> 3	0.2-2.5	2	91503 ¹⁾	01004
	≥ 65	≤ 5.5	-200 ± 300	> 3	0.2-2.5	2	01001 ¹⁾	01027
rotor tags over 100°	≥ 40	≤ 5.5	-400 ± 300	> 3	0.2-2.5	3	01025 ¹⁾	01028
	≥ 65	≤ 5.5	-200 ± 300	> 3	0.2-2.5	33	01026 ¹⁾	

¹⁾ Without bottom adjustment

VARIABLE CAPACITORS

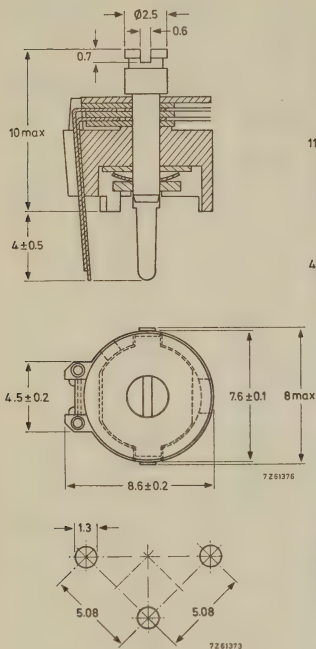


Fig. 1

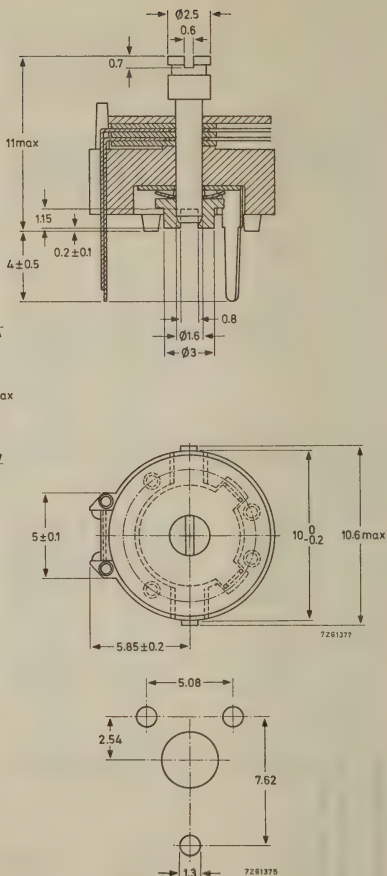


Fig. 2

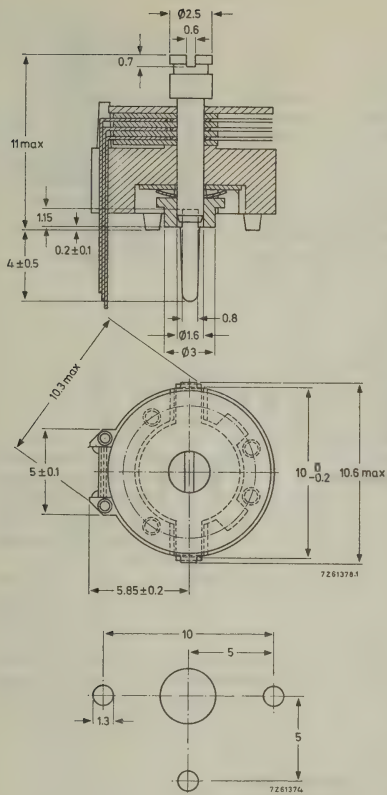


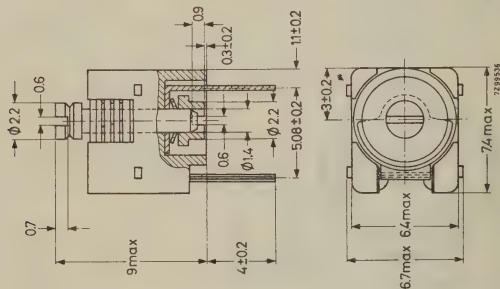
Fig. 3

VARIABLE CAPACITORS

Temperature range: -40 to $+125^{\circ}\text{C}$

Rated voltage: 300 V d.c.

max. cap. (pF)	min. cap. (pF)	temp. coeff. ($10^{-6}/\text{deg C}$)	$\tan \delta$ 100 MHz ($M\Omega$)	operating torque (Ncm)	catalogue number 2222 809 050 ..	
					top adjustment	top + bottom adjustment
≥ 3.5	≤ 1	-250 ± 150	$< 20 \cdot 10^{-4}$	0.1–1.5	01	04
≥ 10	≤ 1.8	-300 ± 75	$< 20 \cdot 10^{-4}$	0.25–2.0	02	05
≥ 18	≤ 2	-350 ± 75	$< 40 \cdot 10^{-4}$	0.25–2.0	03	06



Temperature range: -40 to $+125^{\circ}\text{C}$

Temperature coefficient 0 ± 200 ppm/deg C

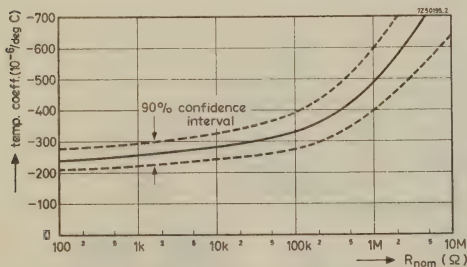
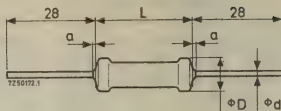
operating torque 1.0–3.5 N cm

max. cap. (pF)	min. cap. (pF)	$\tan \delta$ 1 MHz ($M\Omega$)	rated voltage (V d.c.)	catalogue number 2222 809 070 ..
≥ 20	≤ 4	$< 17 \cdot 10^{-4}$	350	08
≥ 60	≤ 5	$< 25 \cdot 10^{-4}$	200	11
≥ 100	≤ 7	$< 25 \cdot 10^{-4}$	200	15

FIXED RESISTORS

Carbon film resistors

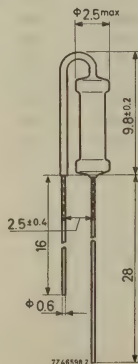
style	$D_{\max.}$	$L_{\max.}$	$a_{\max.}$	d
CR16	1.6	4.5	1.0	0.4
CR25	2.5	7.5	1.0	0.6
CR37	3.7	10	1.0	0.7
CR52	5.2	18	1.2	0.8
CR68	6.8	18	1.2	0.8
¹⁾ CR93 (5 %)	9.3	32	1.2	0.8
CR93 (1 %)	9.3	38.5	3.2	1



Temperature coefficient as a function of the resistance value,
applicable to all resistor styles.

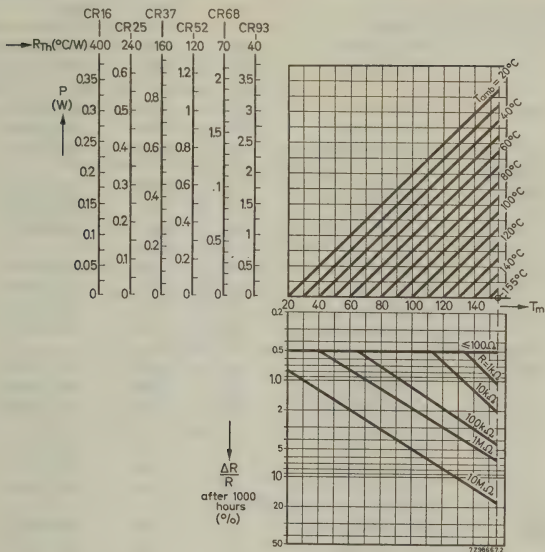
Style CR25A

The bent lead is partly covered with an insulating lacquer having a breakdown voltage of minimum 50 V_{d.c.}



¹⁾ Lead length 36 mm.

Minimum ambient temperature -55°C
 Max. hot-spot temperature 155°C



Performance nomogram for the different styles of resistor, showing the relationship between power dissipation P , ambient temperature T_{amb} , hot-spot temperature T_m , resistance value R and max. resistance drift $\Delta R/R$ after 1000 hours operation.

FIXED RESISTORS

Standard range

style	limiting voltage V_{rms}	resistance range	tolerance \pm	series	catalog number
CR16	150	10 Ω –220 k Ω	5%	E24	2322 210 13 ...
		270 k Ω –1 M Ω	10%	E12	2322 210 12 ...
CR25	250	1 Ω –1 M Ω	5%	E24	2322 101 33 ...
		10 Ω –220 k Ω	2%	E24	2322 101 34 ...
		1.2 M Ω –10 M Ω	10%	E12	2322 101 32 ...
CR25A	250	1 Ω –1 M Ω	5%	E24	2322 106 33 ...
		10 Ω –220 k Ω	2%	E24	2322 106 34 ...
		1.2 M Ω –10 M Ω	10%	E12	2322 106 32 ...
CR37	350	1 Ω –1 M Ω	5%	E24	2322 212 13 ...
		10 Ω –1 M Ω	2%	E24	2322 212 14 ...
		10 Ω –1 M Ω	1%	E24	2322 222 0...0
		1.2 M Ω –10 M Ω	10%	E12	2322 212 12 ...
CR52	500	1 Ω –1 M Ω	5%	E24	2322 101 63 ...
		10 Ω –1 M Ω	1%	E24	2322 223 8...0
		1.2 M Ω –22 M Ω	10%	E12	2322 101 62 ...
CR68	750	1 Ω –1.6 M Ω	5%	E24	2322 214 13 ...
		10 Ω –1.6 M Ω	1%	E24	2322 224 0...0
		1.8 M Ω –22 M Ω	10%	E12	2322 214 12 ...
CR93	1000	10 Ω –22 M Ω	5%	E24	2322 215 13 ...
		10 Ω –1.6 M Ω	1%	E24	2322 225 8...0

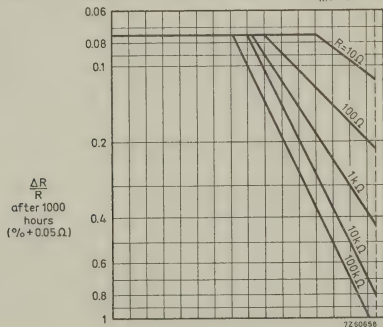
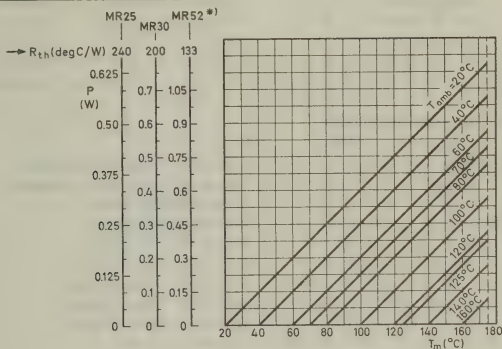
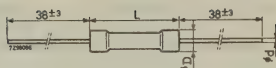
Composition of the catalog number

In the above mentioned catalog number replace the first two dots by the first two digits of the resistance value. Replace the third dot by a figure according to the following table:

1– 9.1 Ω	8	10– 91 k Ω	3
10– 91 Ω	9	100–910 k Ω	4
100–910 Ω	1	1– 9.1 M Ω	5
1– 9.1 k Ω	2	10– 22 M Ω	6

Lacquered metal film resistors
temperature coefficient 100 ppm/deg C

style	D_{max}	L_{max}	d
MR25	2.5	6.5	0.6
MR30	3.0	10.0	0.6
MR52	5.2	16.0	0.6



Performance nomogram for different styles of resistor, showing the relationship between power dissipation P , ambient temperature T_{amb} , hot-spot temperature (T_m) and max. resistance drift $\Delta R/R$ after 1000 hours of operation.

FIXED RESISTORS

Standard range

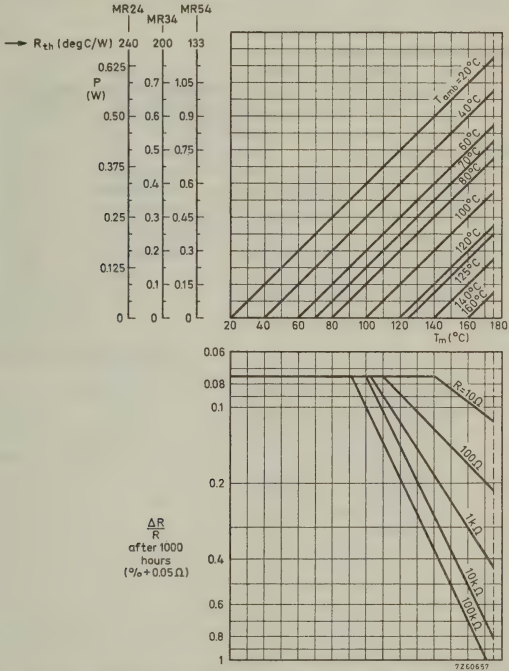
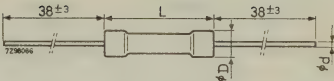
style	resistance range	tolerance (\pm %)	series	limiting voltage (V)	cat. number 2322 followed by
MR25	4.99 Ω –301 k Ω	1	E 96	250	151 5
MR25	5.1 Ω –300 k Ω	2	E 24	250	151 4
MR30	4.99 Ω –1 M Ω	1	E 96	350	152 5
MR30	5.1 Ω –1 M Ω	2	E 24	350	152 4
MR52	4.99 Ω –1 M Ω	1	E 96	500	153 5
MR52	5.1 Ω –1 M Ω	2	E 24	500	153 4

Composition of the catalogue number

Style code —————	2322	Resistance value code first three significant figures of the resistance value (in Ω) followed by
see table		8 for R of 4.99 to 9.76 Ω
		9 for R of 10 to 97.6 Ω
		1 for R of 100 to 976 Ω
		2 for R of 1 to 9.76 k Ω
		3 for R of 10 to 97.6 k Ω
		4 for R of 100 to 976 k Ω
		5 for R of 1 M Ω

Lacquered metal film resistors
temperature coefficient 50 ppm/deg C

Style	D_{max}	L_{max}	d
MR24	2.5	6.5	0.6
MR34	3.1	10.5	0.6
MR54	5.2	16.5	0.6



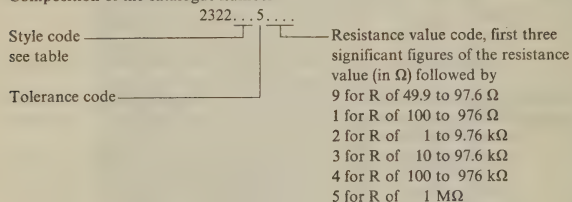
Performance nomogram for different styles of resistor, showing the relationship between power dissipation P , ambient temperature T_{amb} , hot-spot temperature (T_m) and max. resistance drift $\Delta R/R$ after 1000 hours of operation.

FIXED RESISTORS

Standard range

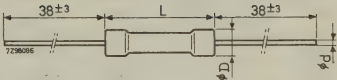
<i>style</i>	<i>resistance range</i>	<i>tolerance (\pm %)</i>	<i>series</i>	<i>limiting voltage (V)</i>	<i>cat. number 2322 followed by</i>
MR24	49.9 Ω –301 k Ω	1	E96	250	161 5
MR34	49.9 Ω –681 k Ω	1	E96	350	164 5
MR54	49.9 Ω – 1 M Ω	1	E96	500	167 5

Composition of the catalogue number



Lacquered metal film resistors
according to MIL-R-10509F

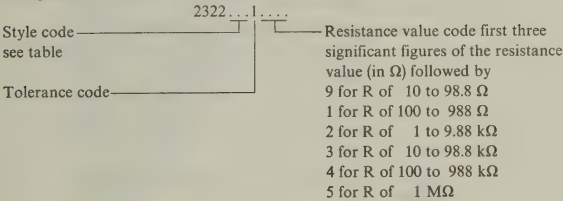
style	D_{max}	L_{max}	d
MR24C/D	2.5	6.5	0.6
MR34C/D	3.1	10.5	0.6
MR54C/D	5.2	16.5	0.6



Standard range

style	rated dissipation (W)	maximum temp. coefficient (ppm/degC)	resistance range E96 series, 1 %	max. voltage (V)	MIL style	cat. number 2322 followed by
	at 125°C					
MR24C	0.1	50	49.9 Ω–100 Ω	200	RN55C	161 1
MR34C	0.125	50	49.9 Ω–499 kΩ	250	RN60C	164 1
MR54C	0.25	50	49.9 Ω– 1 MΩ	300	RN65C	167 1
	at 70°C					
MR24D	0.125	100	10 Ω–301 kΩ	200	RN55D	162 1
MR34D	0.25	100	10 Ω– 1 MΩ	300	RN60D	165 1
MR54D	0.5	100	10 Ω– 1 MΩ	350	RN65D	168 1

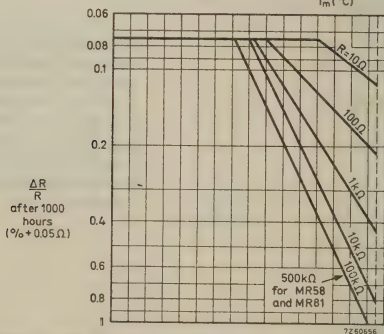
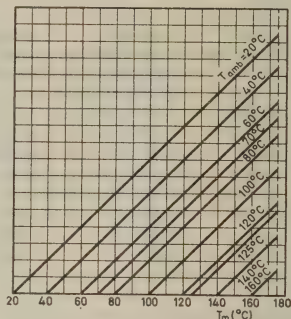
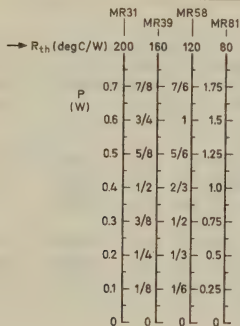
Composition of the catalogue number



FIXED RESISTORS

Moulded metal film resistors according to MIL-R-10509F

style	$D \pm 0.2$	$L \pm 0.2$	d
MR31	3.1	6.9	0.6
MR39	3.9	10.9	0.6
MR58	6.3	17.6	0.6
MR81	8.1	20.5	0.8

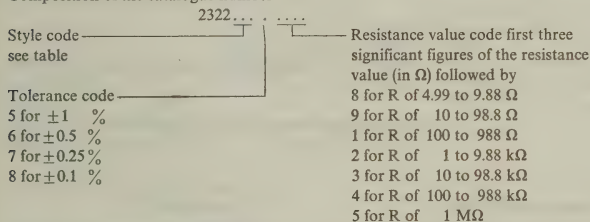


Performance nomogram for different styles of resistor, showing the relationship between power dissipation P , ambient temperature T_{amb} , hot-spot temperature (T_m) and max. resistance drift $\Delta R/R$ after 1000 hours of operation.

Standard range

<i>style</i>	<i>maximum temp. coeff. (ppm/degC)</i>	<i>resistance range</i>	<i>tolerance (± %)</i>	<i>series</i>	<i>limiting voltage (V)</i>	<i>cat. number 2322 followed by</i>
MR31E	25	49.9 Ω-100 kΩ	0.1/0.25/0.5/1	E192 ¹⁾	250	123
MR31C	50	49.9 Ω-100 kΩ	0.1/0.25/0.5	E192	250	124
MR39E	25	49.9 Ω-499 kΩ	0.1/0.25/0.5/1	E192 ¹⁾	350	126
MR39C	50	49.9 Ω-499 kΩ	0.1/0.25/0.5	E192	350	127
MR58E	25	49.9 Ω- 1 MΩ	0.1/0.25/0.5/1	E192 ¹⁾	500	129
MR58C	50	49.9 Ω- 1 MΩ	0.1/0.25/0.5	E192	500	130
MR81E	25	24.9 Ω- 1 MΩ	0.1/0.25/0.5/1	E192 ¹⁾	750	132
MR81C	50	24.9 Ω- 1 MΩ	0.1/0.25/0.5/1	E192 ¹⁾	750	133
MR81D	100	4.99 Ω- 1 MΩ	1	E 96	750	134 5 ...

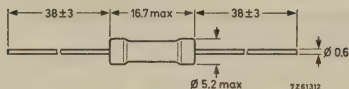
Composition of the catalogue number



¹⁾ For 1 % tolerance E96 values only.

FIXED RESISTORS

Power metal film resistors PR52



Resistance range	10 Ω to 4.7 k Ω , E24 series
Resistance tolerance	$\pm 5\%$
Temperature coefficient	max. 500 ppm/deg C
Max. body temperature (hot spot)	300 °C
Rated dissipation at $T_{amb} = 70^\circ\text{C}$	2.5 W
Limiting voltage	350 V
Ambient temperature range	-55 to +200 °C
Basic specification	MIL-R-11804/2B, char. G

Composition of the catalogue number

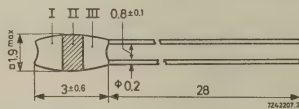
	2322 192 3 . 0 .	
Style code	2322 192 3	9 for R of 10 to 91 Ω 1 for R of 100 to 910 Ω 2 for R of 1000 to 4700 Ω
Tolerance code	. 0 .	First 2 digits of the resistance value

Insulated pin-head carbon resistors

Max. dissipation at 70 °C	0.05 W
Resistance values	47 Ω to 120 k Ω , E12 series
Tolerance	$\pm 10\%$ and $\pm 20\%$
Noise	< 10 $\mu\text{V/V}$
Limiting voltage, peak value	50 V_p
Temperature coefficient (from +25 to +70 °C)	(+1000 to -2000) $10^{-6}/\text{deg C}$

Ambient temperature range -10 to +100 °C

International colour code



Composition of the catalog number

For tolerance $+10\%$: 2322 120 22 . . .

For tolerance $+20\%$: 2322 120 21 . . .

The first two digits of
the resistance value,
neglecting a decimal point.

digit for multiplying factor:

9 = $\times 1$

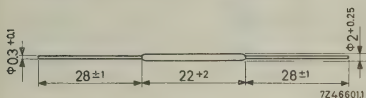
1 = $\times 10$

2 = $\times 100$

3 = $\times 1000$

4 = $\times 10000$

Low-ohmic glass-sealed wire resistors



Maximum dissipation at 40°C

1 W

Resistance values

0.1 to 6.8 Ω , E12 series

Tolerance

$\pm 10\%$

Temperature coefficient

$(-50 \text{ to } +150) 10^{-6}/\text{deg C}$

Operating body temperature

$-25 \text{ to } +275^\circ\text{C}$

Composition of the catalog number

2322 327 61 . . .

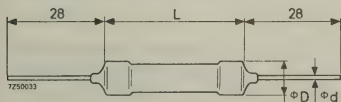
The first two digits of
the resistance value,
neglecting a decimal point.

digit for multiplying factor:

7 = $\times 0.01$

8 = $\times 0.1$

Precision wire-wound resistors

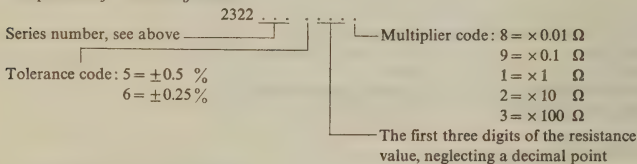


FIXED RESISTORS

Max. dissipation at 40°C	0.4 to 1.8 W
Resistance values	1 Ω to 57 k Ω , E192 series
Tolerance	$\pm 0.5\%$ and $\pm 0.25\%$
Temperature coefficient (\pm)	$< 20 \cdot 10^{-6}/\text{deg C}$
Ambient temperature range	-55 to +110°C

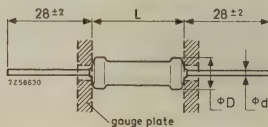
P_{nom} (W)	nominal resistances		$D_{\text{max.}}$	$L_{\text{max.}}$	d	catalog series number
	min. (Ω)	max. (k Ω)				
0.4	1	3.2 ¹⁾	4	13	0.8	260
0.6	3	7	5	19	0.8	261
0.7	6	12.5	5	28	0.8	262
1.2	17	33	7	43	1	263
1.8	25	57	7	67	1	264

Composition of the catalog number



Cemented wire-wound resistors

style	$D_{\text{max.}}$	$L_{\text{max.}}$	d
WR0617	6	19	0.6
WR0825	8	27	0.8
WR0842	8	44	0.8
WR0865	8	67	0.8



¹⁾ 487 Ω for tolerance of 0.25%

Max. permissible surface temperature	400°C
Ambient temperature range	-40 to +155°C
Temperature coefficient	-50 to +160 · 10 ⁻⁶ /degC

style	dissipation at 40°C	resistance range (E12 series)	tolerance	catalog number
WR0617	4 W	5.6–47 Ω	±10%	2322 325 36 ...
		56–4700 Ω	±5%	2322 325 37 ...
WR0825	7 W	6.8–27 Ω	±10%	2322 325 26 ...
		33–10000 Ω	±5%	2322 325 27 ...
WR0842	9.5 W	10–10000 Ω	±5%	2322 325 17 ...
WR0865	15 W	15–16000 Ω	±5%	2322 325 07 ...

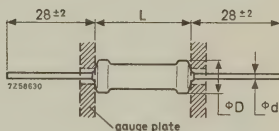
Catalog number suffix

In the above mentioned catalog number replace the first two dots by the first two digits of the resistance value. Replace the third dot by a figure according to the following table:

5.6–	9.1 Ω:	8
10 –	91 Ω:	9
100 –	910 Ω:	1
1000 –	9100 Ω:	2
10000 –	16000 Ω:	3

Enamelled wire-wound resistors

style	D_{max}	L_{max}	d
WR0617E	6	19	0.6
WR0825E	8	27	0.8
WR0842E	8	44	0.8
WR0865E	8	67	0.8



Maximum body temperature	400°C
Ambient temperature range	-55 to +200°C
Temperature coefficient	WR0617E 4.7 to 16 Ω > 16 Ω
	WR0825E 6.8 to 33 Ω > 33 Ω
	WR0842E and WR0865E

400°C
-55 to +200°C
(-50 to +250) ppm/degC
(-50 to +140) ppm/degC
(-50 to +250) ppm/degC
(-50 to +140) ppm/degC
(-50 to +140) ppm/degC

FIXED RESISTORS

<i>style</i>	<i>rated dissipation at $T_{amb} = 70^{\circ}C$</i>	<i>resistance range</i>	<i>tolerance</i>	<i>series</i>	<i>catalogue number</i>
WR0617E	4.2 W	4.7– 47 Ω 51– 4700 Ω	$\pm 10\%$ $\pm 5\%$	E12 E24	2322 330 21 ... 2322 330 22 ...
WR0825E	7 W	6.8– 27 Ω 30– 27000 Ω	$\pm 10\%$ $\pm 5\%$	E12 E24	2322 330 31 ... 2322 330 32 ...
WR0842E	11 W	10– 56000 Ω	$\pm 5\%$	E24	2322 330 42 ...
WR0865E	17 W	15–100000 Ω	$\pm 5\%$	E24	2322 330 52 ...

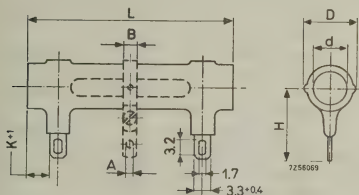
Composition of the catalogue number

In the above mentioned catalogue number replace the first two dots by the first two digits of the resistance value. Replace the third dot by a figure according to the following table:

4.7–	9.1 Ω :	8
10 –	91 Ω :	9
100 –	910 Ω :	1
1000 –	9100 Ω :	2
10000 –	91000 Ω :	3
100000	Ω :	4

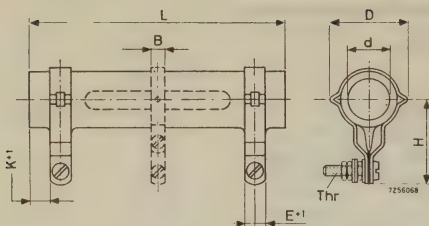
Fixed and adjustable wire-wound resistors with side terminations

	<i>cemented</i>	<i>enamelled</i>
Max. dissipation at 40°C (P_{nom})	8(10)–250 W	8(10)–100 W
Resistance values (E12 series)	1 Ω–11 kΩ	160 Ω–120 kΩ (47 kΩ)
Tolerance	±5% (±10%)	±5%
Temperature coefficient	(–50 to +140) 10 ^{–6} /deg C	
Ambient temperature range	–55 to +155°C	



Resistors with $P_{nom} \leq 40$ W

FIXED RESISTORS



Resistors with $P_{nom} \geq 60 \text{ W}$

P_{nom} (W)	dimensions in mm								
	$D_{max.}$	$d_{min.}$	H	K	E	$L_{max.}$	B	A	Thr
8	11.5	5	14	2.5	—	26	—	—	—
10	11.5	5	14	4	—	41	5	2.8	—
16	11.5	5	14	4	—	63	5	2.8	—
25	16	8	14	4	—	64	6	3.2	—
40	16	8	14	4	—	103	6	3.2	—
60	32	12.5	33	6	9	103	6	—	M4
100	32	12.5	33	6	9	165	6	—	M4
160	44	20	40	8	11	165	8	—	M4
250	44	20	40	8	11	256	8	—	M4

Composition of the catalog number

2322

See table

The first two digits of the resistance value, neglecting a decimal point.

Multiplier code: $8 = \times 0.1 \Omega$

$9 = \times 1 \Omega$

$1 = \times 10 \Omega$

$2 = \times 10^2 \Omega$

$3 = \times 10^3 \Omega$

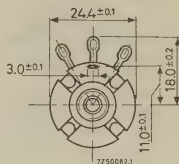
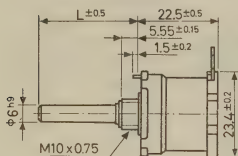
$4 = \times 10^4 \Omega$

coating	P_{nom} ¹⁾ (W)	resistance values R_{nom} ¹⁾				short circuit ¹⁾ (% R_{nom})	D_{max} mm	L_{max} mm	catalog number 2322 followed by	
		tol. (± . . %)	min. (Ω)	maxim. (Ω)					fixed	adjust.
				fixed	adjust.					
cement	8	10	1	100			11.5	26	323 14 ...	
		5	110	150					323 34 ...	
enamel		5	160	6800					321 34 ...	
cement	10	10	1.2	27	27	9	11.5	41	323 12 ...	324 12 ...
		5	30	300	300				323 32 ...	324 32 ...
enamel		5	330	12000	3300				321 32 ...	322 32 ...
cement	16	10	1.5	2.7	2.7	5	11.5	63	323 10 ...	324 10 ...
		5	3	620	620				323 30 ...	324 30 ...
enamel		5	680	24000	6800				321 30 ...	322 30 ...
cement	25	10	2.7	15	15	4	16	64	323 08 ...	324 08 ...
		5	16	820	820				323 28 ...	324 28 ...
enamel		5	1000	39000	9100				321 28 ...	322 28 ..
cement	40	5	4.7	1600	1600	2.5	16	103	323 26 ...	324 26 ...
enamel		5	1800	75000	18000				321 26 ...	322 26 ...
cement	60	5	3	2200	2200	3	32	103	323 24 ...	324 24 ...
enamel		5	2400	68000	24000				321 24 ...	322 24 ...
cement	100	5	6.8	4300	4300	1.5	32	165	323 23 ...	324 23 ...
enamel		5	4700	120000	47000				321 23 ...	322 23 ...
cement	160	5	10	6800	6800	1.5	44	165	323 22 ...	324 22 ...
cement	250	5	16	11000	11000	1	44	256	323 21 ...	324 21 ...

¹⁾ The adjustable contact short-circuits a number of windings. The maximum resistance loss has been given as a percentage of the nominal resistance. Nominal dissipation and nominal resistance values apply if no contact strap were connected.

VARIABLE RESISTORS

Wire-wound trimming potentiometers



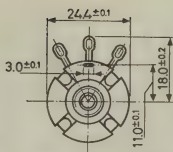
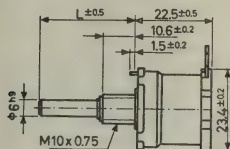
Maximum permissible dissipation at 40°C 3 W
 at 70°C 2 W

<i>adjustment</i>	<i>spindle length</i>	<i>catalog number</i>
screw driver	9 mm	2322 000 02 ...
knob	15 mm	2322 000 22 ...
knob	20 mm	2322 000 32 ...

<i>resistance values</i> (Ω) ± 5%	<i>catalog number suffix</i>
47	479
50	509
68	689
75	759
100	101
150	151
200	201
220	221
250	251
330	331

<i>resistance values</i> (Ω) ± 5%	<i>catalog number suffix</i>
470	471
500	501
680	681
750	751
1000	102
1500	152
2000	202
2200	222
2500	252
3300	332

Wire-wound potentiometers



724.9677.1

Maximum permissible dissipation at 40°C: 3 W
at 70°C: 2 W

adjustment	spindle length <i>L</i>	catalog number
screw driver	14 mm	2322 003 0 ... ¹⁾ 010 0 ... ²⁾
knob	17 mm	2322 003 2 ... 010 2 ...
knob	20 mm	2322 003 3 ... 010 3 ...
knob	30 mm	2322 003 4 ... 010 4 ...
knob	60 mm	2322 003 5 ... 010 5 ...

¹⁾ 2322 003 for radial soldering tags
²⁾ 2322 010 for tags in axial direction

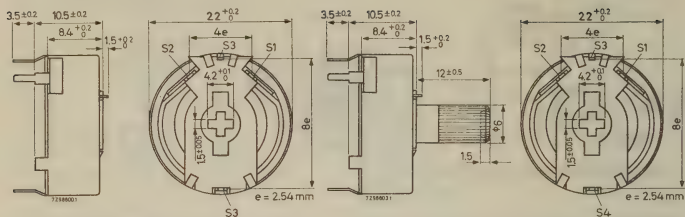
1 = $R \pm 10\%$
2 = $R \pm 5\%$
6 = $R \pm 10\%$ with center tap
7 = $R \pm 5\%$ with center tap

resistance value in Ω	temperature coefficient in $10^{-6}/\text{deg } C$	catalog number suffix
2.2	0 to +600	228
3.3	0 to +600	338
4.7	0 to +600	478
6.8	0 to +600	688
10	0 to +600	109
15	0 to +600	159
22	0 to +600	229
33	-25 to +600	339
47	-25 to +600	479
68	-25 to +25	689
100	-25 to +25	101
150	-25 to +25	151
220	-25 to +25	221

resistance value in Ω	temperature coefficient in $10^{-6}/\text{deg } C$	catalog number suffix
330	-25 to +140	331
470	-25 to +140	471
680	0 to +140	681
1000	0 to +140	102
1500	0 to +140	152
2200	0 to +140	222
3300	0 to +140	332
4700	0 to +140	472
6800	0 to +140	682
10000	-20 to +140	103
15000	-20 to +140	153
22000	-20 to +140	223

VARIABLE RESISTORS

Wire-wound trimming potentiometers



Non-tapped potentiometer without knob

Tapped potentiometer with knob

For mounting on printed-wiring boards

Maximum permissible dissipation at 40°C: 2 W
at 70°C: 1 W

Catalog number: 2322 011

02 = without tap, without knob

03 = with tap, without knob

22 = without tap, with knob

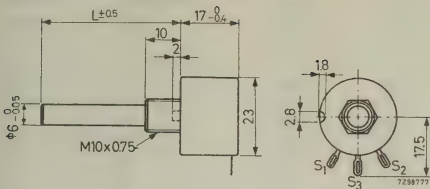
23 = with tap, with knob

resistance code, see table

resistance value $\pm 10\%$ (Ω)	resistance code
2.2	228
3.3	338
4.7	478
6.8	688
10	109
15	159
22	229
33	339
47	479
68	689
100	101

resistance value $\pm 10\%$ (Ω)	resistance code
120	121
150	151
180	181
220	221
330	331
470	471
680	681
1000	102
11 + 11	229
50 + 50	101
150 + 150	301

Wire-wound potentiometers



Maximum permissible dissipation at 70°C: 1 W

adjustment	spindle length L	catalog number
screwdriver	14	2322 01
knob	17	0
knob	25	2
knob	50	3
knob	60	4
knob	20	5
knob	30	6
		7

2 = plastic spindle
3 = steel spindle

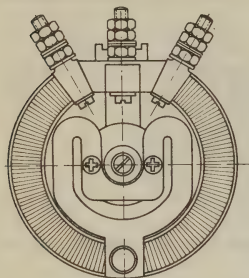
1 = $R \pm 10\%$
2 = $R \pm 5\%$ ($R > 47\ \Omega$)

resistance value in Ω	temperature coefficient in $10^{-6}/\text{deg C}$	catalog number suffix
2.2	0 to +600	228
3.3	0 to +600	338
4.7	0 to +600	478
6.8	0 to +600	688
10	0 to +600	109
15	0 to +600	159
22	-25 to +25	229
33	-25 to +25	339
47	-25 to +25	479
68	-25 to +25	689
100	-25 to +25	101
150	-25 to +25	151

resistance value in Ω	temperature coefficient in $10^{-6}/\text{deg C}$	catalog number suffix
220	0 to +140	221
330	0 to +140	331
470	0 to +140	471
680	0 to +140	681
1000	0 to +140	102
1500	0 to +140	152
2200	0 to +140	222
3300	0 to +140	332
4700	0 to +140	472
6800	0 to +140	682
10000	-20 to +140	103
15000	-20 to +140	153
22000	-20 to +140	223

VARIABLE RESISTORS

Load potentiometers

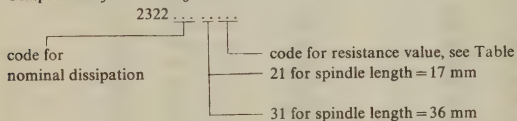


max. perm. dissipation	dimensions in mm		catalog number
	diameter	length*)	
25 W	36	26	2322 095
40 W	46	32	2322 096
100 W	66	48	2322 097

*) behind mounting panel

Temperature coefficient $(-140 \text{ to } +140) 10^{-6} / \text{deg C}$
 Ambient temperature range $-55 \text{ to } +100^{\circ}\text{C}$

Composition of the catalog number



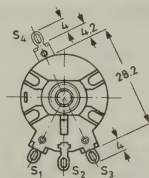
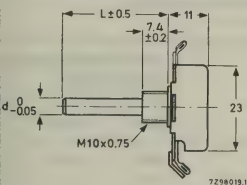
resistance values $\pm 10\%$	resistance code	resistance values $\pm 10\%$	resistance code
0.5 Ω ¹⁾	507	100 Ω	101
0.75 ²⁾	757	150	151
1	108	200	201
1.5	158	250	251
2	208	350	351
2.5	258	500	501
3.5	358	750	751
5	508	1000	102
7.5	758	1500	152
10	109	2000	202
15	159	2500	252
20	209	3500	352
25	259	5000	502
35	359	7500	752
50	509	10000 ²⁾	103
75	759		

¹⁾ Not available in 25 W and 100 W. ²⁾ Not available in 25 W.

Ganging units

For ganging two load potentiometers ganging units are available.

23 mm single carbon potentiometers



Max. permissible dissipation at 70°C

linear resistance law 0.125 W

logarithmic resistance law 0.0625 W

VARIABLE RESISTORS

16 mm carbon potentiometers (CP16-series)

The CP-16 series includes two types of potentiometers.

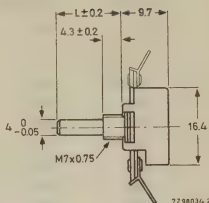
The single potentiometers can be delivered without switch or with a rotary switch, the tandem potentiometers only without switch.

Both types are available with different connecting terminals, mounting facilities and spindles.

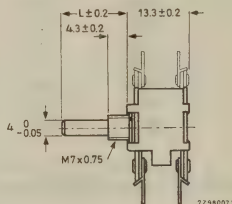
Max. permissible dissipation at 40°C

resistance law a¹⁾: 0.1 W

resistance laws b to f¹⁾: 0.05 W



Single potentiometer



Tandem potentiometer

Composition of the catalog number (see also Tables)

2322
 code for type and switch ———— code for resistance value and law
 code for terminals, mounting ———— code for spindle type
 facility and material of spindle

potentiometer

5th, 6th and 7th digit in
catalog number

	single	tandem
without switch	380	390
with s.p.s.t. rotary switch (spring actuated) ²⁾	381	
with s.p.s.t. rotary switch (direct operating)	387	
without switch, with p.w. pins bent backwards ³⁾	389	

¹⁾ See note 5) page C198.

²⁾ Only available with mounting bushing.

³⁾ Only available with mounting bushing and p.w. pins of 9.3 mm length.

<i>terminals</i>	<i>mounting facility</i>	<i>8th digit in catalog number</i>	
		<i>steel spindle</i>	<i>plastic spindle</i>
p.w. pins, length 3.5 mm or solder tags	mounting bushing	0	7
	twist tags for mounting	2	4
p.w. pins, length 9.3 mm	mounting bushing	1	6
	twist tags for mounting	3	5

<i>spindle length L, see Figs.</i>	<i>9th and 10th digit in catalog number⁴⁾</i>			
	<i>plain</i>	<i>with flat face</i>	<i>knurled</i>	<i>with screw- driver slot</i>
				10
10 mm	11	42	26	
12 mm	09			
15 mm	12	44	27	
17 mm	13			
19 mm	14			
20 mm	15	45	28	
22 mm	17			
24 mm	19			
25 mm	01			
28 mm	02			
30 mm	03			

⁴⁾ For potentiometers with p.w. pins the 9th digit given in this table has to be increased by 5.

VARIABLE RESISTORS

resistance value $\pm 20\%$	11th and 12th digit in catalogue number			
	law a ⁵⁾	law b ⁵⁾	law c ⁵⁾	law f ⁵⁾
220 Ω	02			
470 Ω	03			
1 k Ω	04	24	44	
2.2 k Ω	05	25	45	
4.7 k Ω	06	26	46	
10 k Ω	07	27	47	91
22 k Ω	08	28	48	92
47 k Ω	09	29	49	93
100 k Ω	11	31	51	94
220 k Ω	12	32	52	95
470 k Ω	13	33	53	96
1 M Ω	14	34	54	97
2.2 M Ω	15	35	55	
4.7 M Ω	16			

resistance value $\pm 20\%$	11th and 12th digit in catalog number	
	law d ⁵⁾	law e ⁵⁾
5 + 42 k Ω	72	
20 + 200 k Ω	67	
50 + 420 k Ω	73	
100 + 900 k Ω	64	
2 + 8 k Ω		76
5 + 17 k Ω		82
10 + 37 k Ω		86
20 + 80 k Ω		77
50 + 170 k Ω		83
100 + 370 k Ω		87
0.5 + 1.7 M Ω		84

⁵⁾ a = linear resistance law

b = logarithmic resistance law

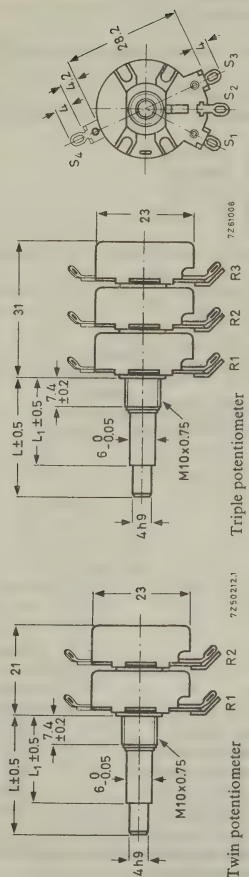
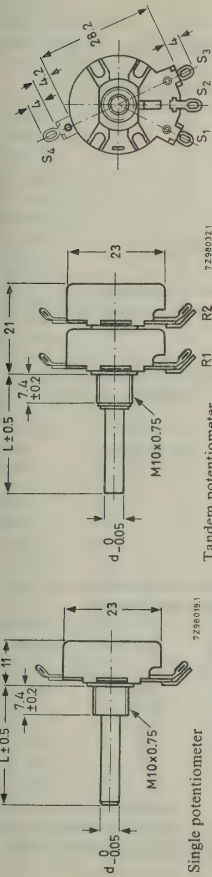
c = reversed logarithmic resistance law

d = resistance law, tap at 10%

e = resistance law, tap at 20%

f = resistance law, balance potentiometers

23 mm carbon potentiometers (CP23-series)



All four types, except the triple potentiometers which are all without switch can be delivered without switch, with a rotary switch or with a push-pull switch, besides all single and tandem potentiometers are available with different connecting terminals, mounting facilities and spindles. The twin and triple potentiometers are supplied with solder tags and mounting bushing.

VARIABLE RESISTORS

Max. permissible dissipation at 70°C
 resistance law a¹⁾: 0.15 W
 resistance laws b to h¹⁾: 0.10 W

Composition of the catalog number of single and tandem types (see also Tables)

2322

code for type and switch ———— }
 code for terminals and mounting ———— }
 facility

3 = p.w. pins } mounting
 7 = solder tags } bushing
 5 = p.w. pins } twist tags
 4 = solder tags } for mounting

code for resistance value and law
 code for spindle type

Composition of the catalog number of twin and triple types (see also Tables)

2322

code for type and switch ———— }
 code for spindle length ———— }
 code for resistance value and law of R₂
 code for resistance value and law of R₁

0 = 18 mm (L₁), 30.5 mm (L₂) } steel
 1 = 30 mm (L₁), 42.5 mm (L₂) } hollow
 } spindle

6 = 18 mm (L₁), 30.5 mm (L₂) } plastic
 7 = 30 mm (L₁), 42.5 mm (L₂) } hollow
 } spindle

¹⁾ See note 4)

potentiometer

5th, 6th and 7th digit in catalog number

	single	tandem	twin ²⁾	triple ²⁾
without switch	350	360	370	378
with s.p.d.t. rotary switch	352	363	372	
with s.p.s.t. rotary switch	353	362	373	
with d.p.s.t. push-pull switch, 1A	354	364	374	
with d.p.s.t. push-pull switch, 2A	355	365	375	
with d.p.d.t. push-pull switch	356			
with d.p.s.t. rotary switch	357	366	376	

²⁾ For potentiometers with steel hollow spindle; for potentiometers with plastic hollow spindle the 5th digit is 4 in stead of 3.

spindle length <i>L</i> , see Figs. (only for single and tandem types)	9th and 10th digit in catalog number ¹⁾				
	plain Ø6 mm	plain Ø6.35 mm	with flat face	knurled	with screw- driver slot
					10
17 mm	13	33			
18 mm	06	26	40	11	
19 mm	14	34			
20 mm	15	35			
22 mm	17	37			
25 mm	01	21	41		
28 mm			42		
30 mm	03	23	43	12	
35 mm	04	24	44		
40 mm	05	25	45		
60 mm	07	27	47	31	
70 mm	08	28	48		
90 mm ²⁾	09	29	49		

¹⁾ For potentiometers with printed-wiring pins the 9th digit given in this table has to be increased by 5. ²⁾ Only for single types.

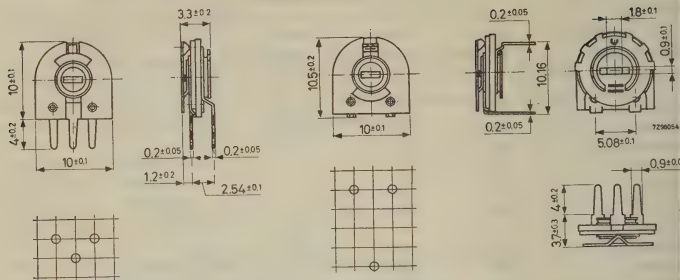
resistance value ± 20 %	11th and 12th digit in catalog number				resistance value ± 20 %	11th and 12th digit in catalog number			
	law a ⁴⁾	law b ⁴⁾	law c ⁴⁾	law h ⁴⁾		law d ⁴⁾	law e ⁴⁾	law f ⁴⁾	law g ⁴⁾
220 Ω	02				20 + 200 kΩ	67			
300 Ω	19		59		50 + 420 kΩ	73			
470 Ω	03		43		100 + 900 kΩ	64			
1 kΩ	04	24	44		0.2 + 2 MΩ	68			
2.2 kΩ	05	25	45		0.5 + 1.7 kΩ		81		
4.7 kΩ	06	26	46		5 + 17 kΩ		82		
10 kΩ	07	27	47		10 + 37 kΩ		86		
22 kΩ	08	28	48	92	20 + 80 kΩ		77		
47 kΩ	09	29	49	93	50 + 170 kΩ		83		
100 kΩ	11	31	51	94	100 + 370 kΩ		87		
200 kΩ	12	32	52	95	200 + 800 kΩ		78		
700 kΩ	13	33	53	96	0.5 + 1.7 MΩ		84		
1 MΩ	14	34	54	97	400 + 600 kΩ			89	
2 MΩ	15	35	55		200 + 100 kΩ				65
7 MΩ	16	36							

a = linear resistance law
b = logarithmic resistance law
c = reversed logarithmic resistance law
d = resistance law, tap at 10 %

e = resistance law, tap at 20 %
f = linear resistance law, tap at 40 %
g = linear resistance law, tap at 67 %
h = resistance law, balance potentiometers

VARIABLE RESISTORS

Miniature carbon trimming potentiometers



Max. permissible dissipation at 40°C : 0.1 W

types	catalog number
for vertical mounting, without knob	2322 410 050 ..
for vertical mounting, with knob	2322 410 450 ..
for horizontal mounting, without knob	2322 410 033 ..
for horizontal mounting, with knob	2322 410 433 ..

resistance value $\pm 20\%$	catalog number suffix
100 Ω	01
220 Ω	02
330 Ω	19
470 Ω	03
1 k Ω	04
2.2 k Ω	05
4.7 k Ω	06

resistance value $\pm 20\%$	catalog number suffix
10 k Ω	07
22 k Ω	08
47 k Ω	09
100 k Ω	11
220 k Ω	12
470 k Ω	13
1 M Ω	14
2.2 M Ω	15
4.7 M Ω	16

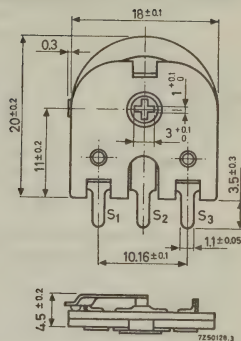
Carbon trimming potentiometers

Max. permissible dissipation at 40°C: 0.25 W

Composition of the catalog number

2322 411

- 0 = without knob
- 1 = with knob at the side of the base plate
- 2 = with knob at the side of the carbon track
- 4 = with adjustment wheel
- 00 = with soldering tags
- 22 = with pins for vertical mounting
- 33 = with pins for horizontal mounting
- 72 = with pins for vertical mounting (according to DIN 44 150)
- 83 = with pins for horizontal mounting (according to DIN 44 150)
- 84 = with pins for horizontal mounting (according to DIN 44 151)

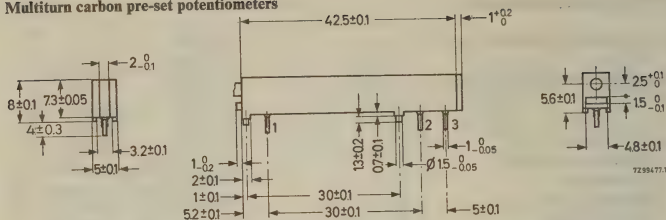


code for resistance value, see table

resistance value $\pm 20\%$	code in catalog number	resistance value $\pm 20\%$	code in catalog number
100 Ω	01	47 k Ω	09
220 Ω	02	100 k Ω	11
330 Ω	19	220 k Ω	12
470 Ω	03	470 k Ω	13
1 k Ω	04	1 M Ω	14
2.2 k Ω	05	2.2 M Ω	15
4.7 k Ω	06	4.7 M Ω	16
10 k Ω	07	10 M Ω	17
22 k Ω	08		

VARIABLE RESISTORS

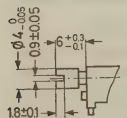
Multiturn carbon pre-set potentiometers



Housing without adjustment provision and scale indicator. Terminals 1 and 2 are connected to the ends of the carbon track, terminal 3 is connected to the slider contact.

adjustment provision

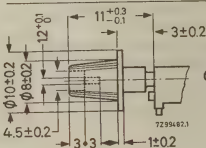
code in
catalog number



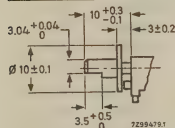
51

adjustment provision

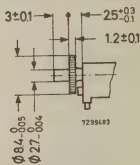
code in
catalog number



63



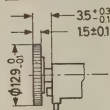
52



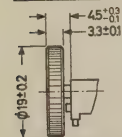
81



61



82

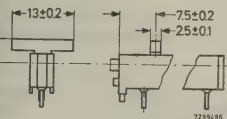


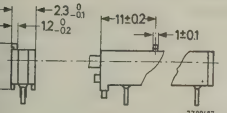
62

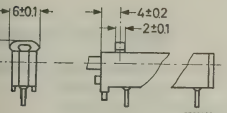


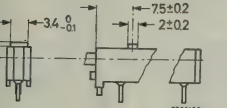
83

indicator	with/without dust cover	code in catalog number
-----------	----------------------------	---------------------------

	without	1
--	---------	---

	without	2
--	---------	---

	without	3
--	---------	---

	without	4
--	---------	---

without indicator	without	0
-------------------	---------	---

without indicator	which	8
-------------------	-------	---

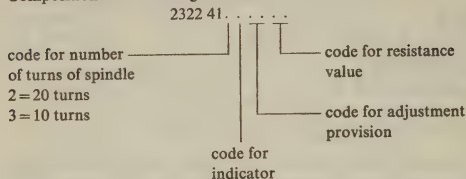
VARIABLE RESISTORS

Max. permissible dissipation at 40°C

linear resistance law 0.4 W

logarithmic resistance law 0.3 W

Composition of the catalog number



resistance value $\pm 20\%$	code in catalog number	
	linear	logarithmic
100 Ω	01	
220 Ω	02	
470 Ω	03	
1 k Ω	04	24
2.2 k Ω	05	25
4.7 k Ω	06	26
10 k Ω	07	27
22 k Ω	08	28
47 k Ω	09	29
100 k Ω *	11	31
220 k Ω	12	32
470 k Ω	13	33
1 M Ω	14	34
2.2 M Ω	15	35
4.7 M Ω	16	

*) Also available with special law; code: 38

Miniature carbon potentiometers

maximum voltage over the
resistance element
current through slider
working-temperature range

$10 V_{d.c.}$
 $\leq 1 \text{ mA}$
 $-10 \text{ to } +70^\circ\text{C}$

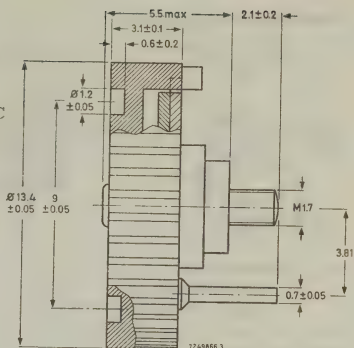
resistance
value
 $\pm 20\%$

catalog number suffix
2322 440 000 ..

linear logarithmic

700 Ω
1000 Ω
2000 Ω

06 26
07 27
08 28

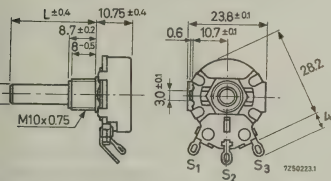


Single carbon potentiometers

max. permissible dissipation at 40°C

linear resistance law 1 W

logarithmic resistance law 0.5 W



handle type (plastic)

catalog number

length, $L = 17 \text{ mm}$

2322 450 013 ..

$L = 30 \text{ mm}$

003 ..

$L = 60 \text{ mm}$

007 ..

with screwdriver slot,

$\varnothing 6.35 \text{ mm}$, $L = 12.7 \text{ mm}$

904 ..

$L = 22.2 \text{ mm}$

907 ..

$L = 31.8 \text{ mm}$

910 ..

$L = 63.5 \text{ mm}$

920 ..

resistance
values $\pm 20\%$

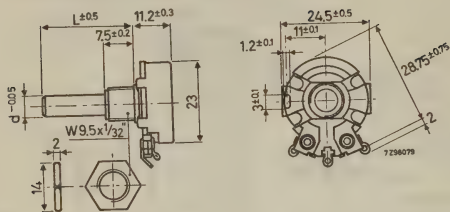
catalog number suffix

linear logarithmic

100 Ω	01	
220 Ω	02	
470 Ω	03	23
1 k Ω	04	24
2.2 k Ω	05	25
4.7 k Ω	06	26
10 k Ω	07	27
22 k Ω	08	28
47 k Ω	09	29
100 k Ω	11	31
220 k Ω	12	32
470 k Ω	13	33
1 M Ω	14	34
2.2 M Ω	15	35
4.7 M Ω	16	

VARIABLE RESISTORS

23 mm single carbon potentiometers



Max. permissible dissipation at 40°C

linear resistance law 1 W

logarithmic resistance law 0.5 W

spindle type (plastic)	catalog number
plain, $d = 6$ mm, $L = 18$ mm	2322 460 706 ..
$L = 30$ mm	703 ..
$L = 60$ mm	707 ..
plain, $d = \frac{1}{4}$ ", $L = 30$ mm	723 ..
$L = 60$ mm	727 ..
with screwdriver slot, $d = 6$ mm,	
$L = 11$ mm	710 ..
with flat face, $d = 6$ mm,	
$L = 18$ mm	740 ..
$L = 30$ mm	743 ..
$L = 60$ mm	747 ..

resistance value $\pm 20\%$	catalog number suffix	
	linear	logarithmic
220 Ω	02	
300 Ω	19	
470 Ω	03	
1 k Ω	04	24
2.2 k Ω	05	25
4.7 k Ω	06	26
10 k Ω	07	27
22 k Ω	08	28

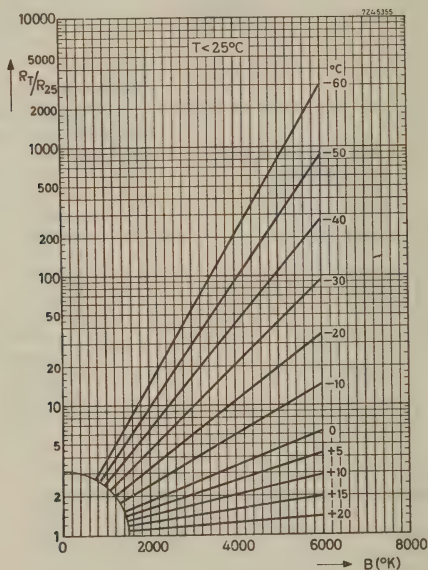
resistance value $\pm 20\%$	catalog number suffix	
	linear	logarithmic
47 k Ω	09	29
100 k Ω	11	31
220 k Ω	12	32
470 k Ω	13	33
1 M Ω	14	34
2.2 M Ω	15	35
4.7 M Ω	16	

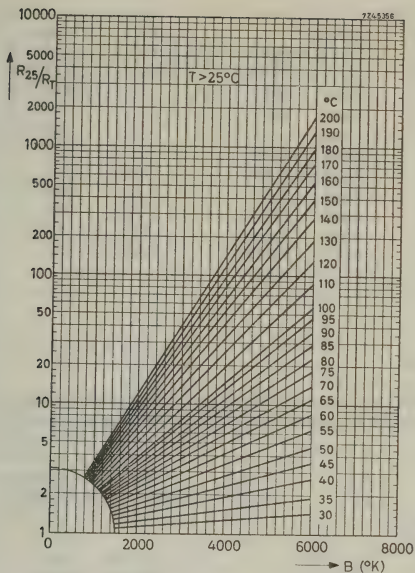
NTC THERMISTORS

NTC thermistors are resistors with a high negative temperature coefficient of resistance. The relation between resistance and temperature can be approximated by:

$$R = A e^{B/T}$$

where R is the resistance value at an absolute temperature T , A and B being constants for a given resistor and e the base of the natural logarithm ($e=2.718$).





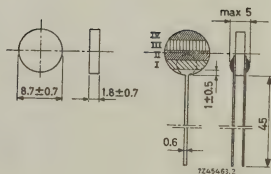
Standard disc types

Catalog number 2322 610

for the suffix of this number see table.

Maximum dissipation 1 W
 Maximum temperature 120°C
 Dissipation factor 10 mW/deg C
 Thermal time constant 60 s

International colour code for resistors.



NTC THERMISTORS

R_{25} $\pm 20\%$ (Ω)	<i>B</i> -value $\pm 5\%$ at 25°C (<i>K</i>)	suffix of catalog number	
		without leads	with leads
2.2	2650	01228	11228
4	2800	01408	11408
6	2800	01608	11608
8	2900	01808	11808
10	2950	01109	11109
12	2950	01129	11129
15	3000	01159	11159

R_{25} $\pm 20\%$ (Ω)	<i>B</i> -value $\pm 5\%$ at 25°C (<i>K</i>)	suffix of catalog number	
		without leads	with leads
33	3250	01339	11339
50	3300	01509	11509
82	4400	01829	11829
130	4600	01131	11131
500	5200	01501	11501
1300	5450	01132	11132

Types for motor cars

This range of discs has been developed for temperature sensors for the cooling water in motor cars. They are also suitable for temperature control in household appliances, such as washing machines.

R_{25} (Ω)	R_{40} (Ω)	R_{50} (Ω)	$R_{96.5}$ (Ω)	R_{100} (Ω)	diameter (mm)	catalog number
2200	1030-1310		147-173		7.0	2322 611 90003
500		175 -215		35 -43	6.9	90013
500		92.5-134		12 -15	6.9	90001
1000		221.5-318.5		30 -36	6.9	90004
270		97 -143		29.5-36.5	6.9	90009
700		207 -264		41.4-48.6	6.9	90011
800		244 -315		48.0-58.6	6.9	90008

application	R_{25} (Ω)	B at 25°C approx. (K)	$W_{\text{max.}}$ (W)	normal operating conditions		dissipation factor approx. (mW/deg C)	max. dia- meter (mm)	max. body length (mm)	catalog number
				(mA)	(Ω)				
compensation positive tem- perature coeff of deflection coils	$1.1 \pm 20\%$	2650	1	2200	0.15-0.25	14	9	21	2322 619 90002
	$32 \pm 30\% / -20\%$	4200	1	1000	0.7-1.1	14	9	21	619 90003
	$6 \pm 20\%$	2800	1	1000	~ 1	10			2322 610
	$10 \pm 20\%$	2950	1	900	~ 1.1	10			610
	$12 \pm 20\%$	2950	1	800	~ 1.2	10			610 *
	$15 \pm 20\%$	3000	1	800	~ 1.2	10			610
heater chain protection	$33 \pm 20\%$	3250	1	700	~ 1.4	10			610
	300 - 500	3700	2.5	300	25-32	30	13	23	622 90005
	645 - 1210	3600	5	300	35-48	60	13	37	622 90004
	2470 - 5370	4000	4	300	38-50	24	11	37	622 90001
protection of switch and Si-diode	$82 \pm 20\%$	4650		1700	< 0.85	19	16		2322 644 9004
	≥ 15	3350		2200	< 1	17	16		644 9005

* See Standard disc types 2322 610

NTC THERMISTORS

Miniature types

Miniature NTC thermistors are available in 7 versions all built around the same NTC-bead. The range of resistance values and the resistance temperature characteristics for all versions are the same.

versions	max. body dimensions mm	terminations at		catalog number
		one side	two sides	
naked bead	1 Ø		×	2322 634 01 ..
naked bead	1 Ø	×		2322 634 11 ..
glass encapsulated bead	12 × 2.5		×	2322 634 21 ..
vacuum mounted	31 × 6	×		2322 634 31 ..
vacuum gauge	87 × 6	×		2322 634 41 ..
thermometer	33 × 2.5	×		2322 627 11 ..
thermometer	5 × 1.5	×		2322 627 21 ..

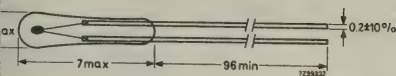
R_{25} ± 10 % (Ω)	B-value ± 5 % at 25°C (K)	catalog number suffix
1000	2350	102
1500	2450	152
2200	2600	222
3300	2775	332
4700	3650	472
6800	3725	682
10000	3800	103
15000	3750	153
22000	3800	223

R_{25} ± 10 % (Ω)	B-value ± 5 % at 25°C (K)	catalog number suffix
33000	3750	333
47000	3800	473
68000	3850	683
100000	3900	104
150000	3975	154
220000	4075	224
330000	4175	334
470000	4225	474
680000	4300	684

Maximum dissipation 60 mW
Maximum temperature 200°C
Dissipation factor approximately 0.4 mW/deg C
Stability after 1000 hrs at T_{max} < 1 %
International colour code for resistors

miniature type 2322 627 3

for high temperature control



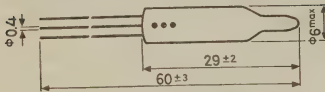
$\pm 20\%$	$B_{25/85} \pm 5\%$ (K)	catalog number
00 000	3800	2322 627 31104
50 000	3850	31154
20 000	3850	31224
30 000	3900	31334
70 000	3950	31474
80 000	3975	31684
00 000	4025	31105

maximum dissipation	0.1 W
dissipation factor	approx. 0.95 mW/deg C
operating temperature range	
at zero power	-55 to +300°C
at max. power	0 to +55°C

NTC THERMISTORS

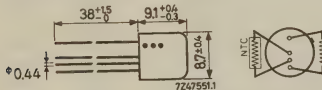
Indirectly heated types

Vacuum mounted in glass



catalog number	2322 628 01332,	2322 628 01334
R_{25}	$3300 \Omega \pm 20 \%$	330 k Ω
B-value	$2775 K \pm 10 \%$	$4175 K \pm 10 \%$
Colour code	orange-orange-red	orange-orange-yellow
$W_{max.}$ heater	30 mW	
$T_{max.}$	200°C	
Resistance heater	$100 \Omega \pm 10 \%$	
$W_{max.}$ NTC	25 mW	
Dissipation factor	0.18 mW/deg C	
Heater efficiency	97.5 %	
Thermal time constant	2.2 s	
Dielectric strength heater/bead	$\geq 200 V$	

Mounted in air-filled metal casing

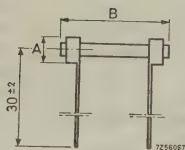


catalog number	2322 628 11332	2322 628 11334
R_{25}	$3300 \Omega \pm 20 \%$	330 k Ω
B-value	$2775 K \pm 5 \%$	$4175 K \pm 5 \%$
Colour code	orange-orange-red	orange-orange-yellow
$W_{max.}$ heater	80 mW	
$T_{max.}$	125°C	
Resistance heater	$100 \Omega \pm 10 \%$	
$W_{max.}$ NTC	60 mW	
Dissipation factor	0.50 mW/deg C	
Heater efficiency	90 %	
Thermal time constant	1.2 s	
Dielectric strength heater/bead	$\geq 200 V$	

Standard rod types

Dimensions in mm

series	A	B
2322 635	3.2 ± 0.5	11 ± 1
2322 636	4.7 ± 0.5	21 ± 1
2322 637	6.2 ± 0.5	31 ± 1



R_{25} $\pm 20\%$ (k Ω)	B-value $\pm 5\%$ at 25°C (K)	$W_{max.}$ at 25°C amb (W)	dissipation factor (mW/deg C)	thermal time constant (s)	colour code	catalog number
4.7	3250	0.6	5.5	28	orange	2322 635 01472
15	3550				green	153
47	3925				blue	473
50	4075				white	154
30	4200				yellow/blue	334
4.7	3250	1.5	12	55	orange	2322 636 01472
15	3550				green	153
47	4000				blue	473
50	4150				white	154
4.7	3250	2.3	17	105	orange	2322 637 01472
15	3650				green	153
47	4050				blue	473
50	4200				white	154

Maximum temperature

Stability ΔR_{25} after 1000 hrs at $W_{max.}$ 150°C $< 5\%$
 ΔR_{25} after 1000 hrs at $\frac{2}{3} W_{max.}$ $< 3\%$

at -10°C

at -30°C

$5/85$ -value

Temperature coefficient at 25°C

Max. dissipation at $T_{amb} = 25^\circ\text{C}$ 0.5 W

Dissipation factor (on a heat-sink)

Thermal time constant (on a heat-sink)

Operating temperature range at zero power

Catalog number

$5000 \Omega \pm 4.5\%$

$13350 \Omega \pm 5\%$

3425 K

$-4\%/^\circ\text{C}$

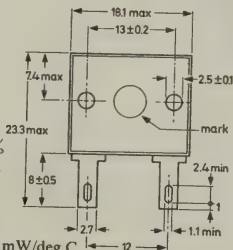
0.5 W

25 mW/deg C

12 s

-55 to $+85^\circ\text{C}$

2322 640 90001

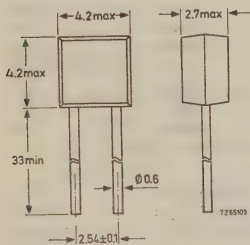


7265020

NTC THERMISTORS

MOULDED TYPE

Catalog number	2322 640 90002	2322 640 90003
Resistance value at $T = -30^{\circ}\text{C}$		$13350\ \Omega \pm 5\%$
$T = -20^{\circ}\text{C}$	$8600\ \Omega \pm 8\%$	$8000\ \Omega \pm 4\%$
$T = -10^{\circ}\text{C}$		$5000\ \Omega \pm 4.5\%$
$T = -0^{\circ}\text{C}$	$3500\ \Omega$	
$T = +25^{\circ}\text{C}$	$1215\ \Omega \pm 7\%$	
Operating temperature range at zero power	$-25\text{ to }+85^{\circ}\text{C}$	$-55\text{ to }+85^{\circ}\text{C}$
$B_{25/85}$ -value	3425 K	
Temperature coefficient at 25°C	$-3.9\%/^{\circ}\text{C}$	
Maximum dissipation	0.25 W	
Dissipation factor	$6.3\text{ mW}/^{\circ}\text{C}$	
(on a heat-sink)	$12.5\text{ mW}/^{\circ}\text{C}$	
Thermal time constant	17 s	
(on a heat-sink)	7 s	



R_{25} $\pm 20\%$ (Ω)	$B_{25/85}$ (K)	dissipation factor (mW/deg C)	thermal time constant (s)	catalog number
3.3	2600	9	30	2322 642 11338
4.7	2665	9	30	11478
6.8	2730	9	30	11688
10	2800	9	30	11109
15	2870	9	30	11159
22	2935	9	25	11229
33	3010	9	25	11339
47	3070	9	25	11479
68	3125	8	25	11689
100	3200	8	25	11101
150	3280	8	25	11151
220	3350	8	25	11221
330	3440	8	25	11331
470	3520	8	25	11471
680	3600	8	25	11681
1000	3680	8	25	11102
1500	3775	8	25	11152
2200	3915	8	25	11222
3300	4070	8	25	11332
4700	4200	8	25	11472
6800	4300	8	25	11682
10000	4400	8	25	11103
15000	4375	8.5	25	11153
22000	4200	8.5	25	11223
33000	4250	8.5	25	11333
47000	4325	8.5	25	11473
68000	4375	8.5	25	11683
100000	4200	8.5	25	11104
150000	4600	8.5	25	11154
200000	4650	8.5	25	11224
300000	4700	8.5	25	11334

max. dissipation at 55°C
operating temperature range at zero power
international colour code for resistors

0.5 W
-25 to +125°C

NTC THERMISTORS

Standard disc type (2322 642 1) with mounting stud

Dissipation factor

without heatsink
mounted on a heatsink of 1 dm²,
thickness 1.5 mm

9.5 mW/degC approx.

19 mW/degC approx.

Thermal time constant

without heatsink
mounted on a heatsink of 1 dm²,
thickness 1.5 mm

80 s approx.

15 s approx.

Max. dissipation at 55°C

0.5 W

Operating temperature range at zero power

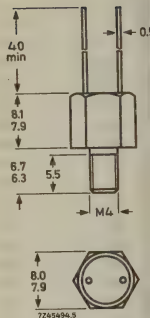
-25 to +100°C

Dielectric withstanding voltage

> 100 V

Insulation resistance

> 100 MΩ



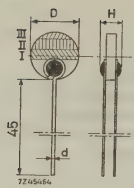
Dimensions in mm

R_{25} ±20% (Ω)	$B_{25/85}$ (K)	catalogue number	R_{25} (Ω)	$B_{25/85}$ (K)	catalogue number
3.3	2600	2322 642 21338	1500	3775	2322 642 21152
4.7	2665	21478	2200	3915	21222
6.8	2730	21688	3300	4070	21332
10	2800	21109	4700	4200	21472
15	2870	21159	6800	4300	21682
22	2935	21229	10000	4400	21103
33	3010	21339	15000	4375	21153
47	3070	21479	22000	4200	21223
68	3125	21689	33000	4250	21333
100	3200	21101	47000	4325	21473
150	3280	21151	68000	4375	21683
220	3350	21221	100000	4200	21104
330	3440	21331	150000	4600	21154
470	3520	21471	220000	4650	21224
680	3600	21681	330000	4700	21334
1000	3680	21102			

Standard disc types

Dimensions in mm

series	D	H _{max}	d
2322 643	9 ± 0.5	6	0.6
2322 644	16 ± 0.5	7	0.8



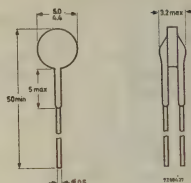
R_{25} ± 20% (Ω)	B-value at 25°C (K)	P_{max} at $T_{amb} = 25°C$ (W)	dissipation factor (mW/deg C)	thermal time constant (s)	catalog number
150	3400	1	10	55	2322 643 11151 11471 11152 11472
470	3800	1	10	55	
1500	4100	1	10	55	
4700	4200	1	10	55	
150	3400	1.5	13	120	2322 644 11151 11471 11152 11472
470	3900	1.5	13	120	
1500	4050	1.5	13	120	
4700	4200	1.5	13	120	

Operating temperature range at zero power -25 to +125°C
International colour code for resistors

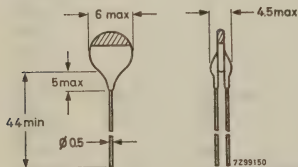
PTC THERMISTORS

DISC TYPE

Resistance at 25°C	250 $\Omega \pm 25\%$
Switch temperature at 80°C	3700 $\Omega \pm 30\%$
Temperature coefficient	+ 5%/deg C
Max. voltage at $T_{amb} = +55^\circ\text{C}$	25 V d.c.
Dissipation factor	6 mW/deg C
Operating temperature range	
at zero power	- 25 to + 155°C
at V_{max}	0 to + 55°C
Catalog number	2322 660 91001



Standard disc type



R_{25} $\pm 30\%$ (Ω)	R_{125} ($k\Omega$)	R_{150} ($M\Omega$)	$T_s^{1)}$ approx. (°C)	max. temp. coeff. (%/deg C)	colour code	catalog number
60	3- 15		+ 30	+ 7	red	2322 660 91006
50	100-500		+ 50	+ 16	orange	91007
50	50-500		+ 80	+ 23	yellow	91008
50		0.1-1.2	+ 105	+ 40	green	91009

Maximum voltage 25 $V_{d.c.}$

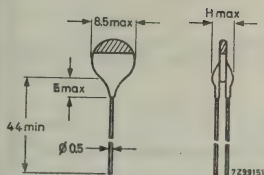
Dissipation factor: approx. 7 mW/deg C

The above resistance values are measured at 1.5 V²⁾

¹⁾ The switch temperature T_s is the higher of the two temperatures at which the resistance is twice the minimum resistance.

²⁾ Higher voltages may yield different values due to self-heating and voltage-dependency.

Standard disc type



For 2322 661 90005 $H_{\max} = 5.5 \text{ mm}$

For other types $H_{\max} = 6.5 \text{ mm}$

$R_{25} \pm 15$ (Ω)	R at other temperatures	$T_s^{1)}$ approx. ($^{\circ}\text{C}$)	max. temp. coeff. (%/deg C)	$V_{\max.}$ ($V_{\text{d.c.}}$)	colour code	catalog number
50	60 $^{\circ}\text{C}$ < 100 Ω 100 $^{\circ}\text{C}$ > 1 k Ω	+ 80	+ 18	50	yellow	2322 661 91002
40	95 $^{\circ}\text{C}$ < 80 Ω 130 $^{\circ}\text{C}$ > 10 k Ω	+ 110	+ 75	50	green	2322 661 91003
30	40 $^{\circ}\text{C}$ < 90 Ω 100 $^{\circ}\text{C}$ > 10 k Ω	+ 45	+ 16	50	orange	2322 661 91004
50	100 $^{\circ}\text{C}$ 3–20 k Ω	+ 25	+ 9	40	red	2322 661 91005

Dissipation factor: approx. 10 mW/deg C

The above resistance values are measured at 1.5 V²⁾

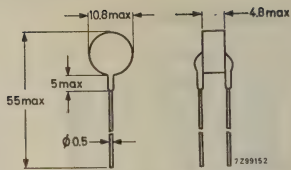
¹⁾ The switch temperature T_s is the higher of the two temperatures at which the resistance is twice the minimum resistance.

²⁾ Higher voltages may yield different values due to self-heating and voltage-dependency.

PTC THERMISTORS

PTC thermistor 2322 662 91001

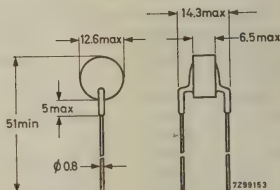
Resistance value at $+25^{\circ}\text{C}$	36 to $50\ \Omega$
Resistance value at $+165^{\circ}\text{C}$	$> 20\ \text{k}\Omega$
$V_{\text{pulse}} = 180\ \text{V}$	115°C approx.
Switch temperature	$35\ \%/^{\circ}\text{C}$ approx.
Temperature coefficient	$180\ V_{\text{d.c.}}$
Max. voltage	$13\ \text{mW}/^{\circ}\text{C}$ approx.
Dissipation factor	
Operating temperature range	
at zero power	0 to $+155^{\circ}\text{C}$
at V_{max}	0 to $+55^{\circ}\text{C}$



For the protection of telegraphy relay contacts

PTC thermistor 2322 662 93036

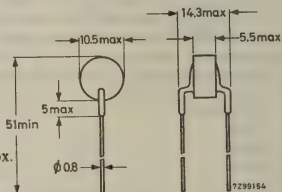
Resistance value at $+25^{\circ}\text{C}$	45 to $60\ \Omega$
Resistance value at $+150^{\circ}\text{C}$	$> 45\ \text{k}\Omega$
$V_{\text{pulse}} = 340\ \text{V}$	$+75^{\circ}\text{C}$ approx
Switch temperature	$+23\ \%/^{\circ}\text{C}$ approx.
Temperature coefficient	$265\ V_{\text{rms}}$
Max. voltage at $T_{\text{amb}} < +60^{\circ}\text{C}$	$17\ \text{mW}/^{\circ}\text{C}$ approx.
Dissipation factor	
Operating temperature range	
at zero power	0 to $+155^{\circ}\text{C}$
at V_{max}	0 to $+60^{\circ}\text{C}$



For use in the degaussing circuit of colour TV sets

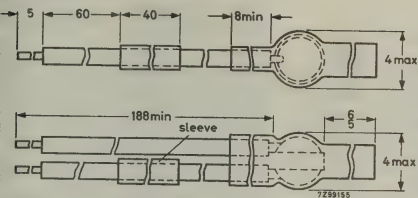
PTC thermistor 2322 662 93066

Resistance value at $+25^{\circ}\text{C}$	$100\ \Omega \pm 20\%$
Resistance value at $+150^{\circ}\text{C}$	$> 40\ \text{k}\Omega$
$V_{\text{pulse}} = 340\ \text{V}$	80°C
Switch temperature	$265\ V_{\text{rms}}$
Max. voltage at $T_{\text{amb}} < +60^{\circ}\text{C}$	$15.3\ \text{mW}/^{\circ}\text{C}$ approx.
Dissipation factor	
Operating temperature range	
at zero power	0 to $+150^{\circ}\text{C}$
at V_{max}	0 to $+60^{\circ}\text{C}$



The thermistor is marked with a red dot
For use in the degaussing circuit of colour TV sets

PTC thermistor for motor protection



Resistance value at -20 and $T_{ref} - 10^{\circ}\text{C}$	20 to 150 Ω
Resistance value at $T_{ref} + 15^{\circ}\text{C}$	
$V_{pulse} = 15\text{ V}$	$> 3500\ \Omega$
Max. voltage	15 V
Dissipation factor	7 mW/deg C approx.
Operating temperature range	
at zero power	-25 to $T_{ref} + 30^{\circ}\text{C}$
at V_{max}	-25 to $T_{ref} + 15^{\circ}\text{C}$

$T_{ref}^{1)}$ ($^{\circ}\text{C}$)	T_s ($^{\circ}\text{C}$)	temperature coefficient %/deg C	catalogue number
30	68	18	2322 672 92045
60	75	21	92046
90	88	31	92047
120	99	33	92048
150	113	38	92049
180	123	27	92051
210	130	33	92052
240	137	33	92053

The temperature at which the thermistor has to make the protection system operative.

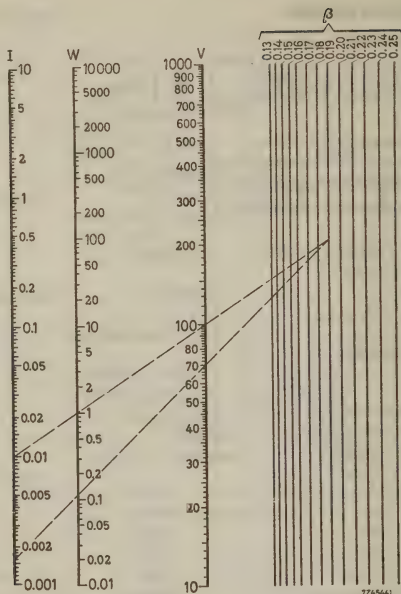
VOLTAGE DEPENDENT RESISTORS

The relation between voltage and current of a VDR resistor can be approximated by:

$$V = C \cdot I^{\beta} \quad (1)$$

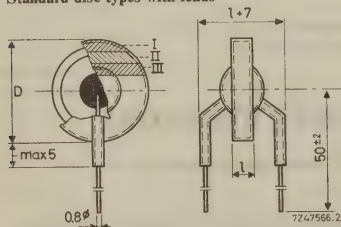
where V is the voltage in volts, I the current in amperes and C and β are constants. This equation is illustrated in the figure on next page.

VOLTAGE DEPENDENT RESISTORS



Nomogram giving the relation between voltage, current, power dissipation and β -value of any VDR

Standard disc types with leads



Temperature range:

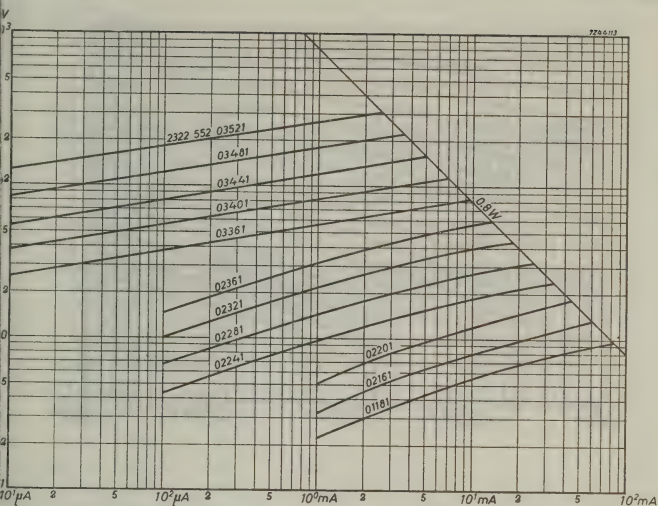
at zero power -25 to $+125^\circ$

at max. power 0 to $+55^\circ$

Tolerance on voltage $\pm 20\%$

Tolerance on voltage is $\pm 20\%$.

$V_{\max.} = 0.8 \text{ W}$
 $l_{\max.} = 14.5 \text{ mm}$

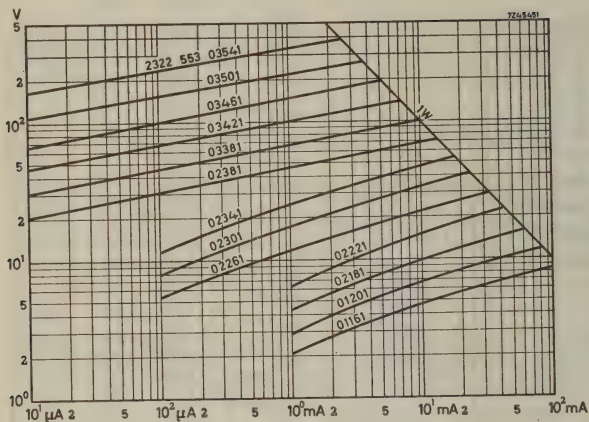


I (mA)	E (V)	β	C approx.	$l_{\max.}$ (mm)	colour code			catalog number
					I	II	III	
00	10	0.25-0.40	18	5	brown	brown	grey	2322 552 01181
10	8	0.25-0.40	25	5	red	brown	blue	02161
10	12	0.25-0.40	40	5	red	red	black	02201
10	18	0.21-0.35	57	5	red	red	yellow	02241
10	27	0.21-0.35	70	5	red	red	grey	02281
10	39	0.18-0.25	100	5	red	orange	red	02321
10	56	0.18-0.25	150	5	red	orange	blue	02361
	56	0.14-0.23	190	5	orange	orange	blue	03361
	82	0.14-0.21	300	5	orange	yellow	black	03401
	120	0.14-0.21	400	6	orange	yellow	yellow	03441
	180	0.14-0.21	600	7	orange	yellow	grey	03481
	270	0.14-0.21	900	8	orange	green	red	03521

VOLTAGE DEPENDENT RESISTORS

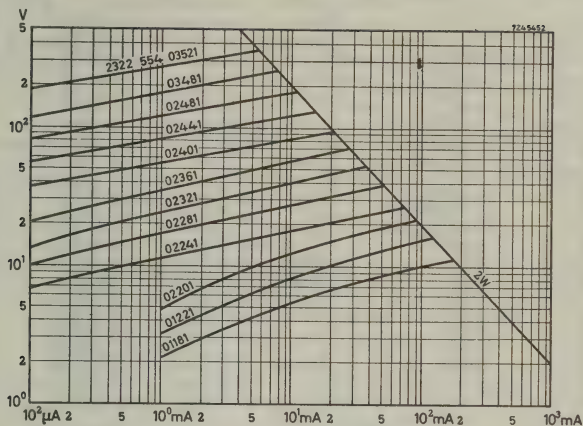
$W_{max.} = 1 \text{ W}$

$D_{max.} = 20 \text{ mm}$



I (mA)	E (V)	β	C approx.	$l_{max.}$ (mm)	colour code			catalog number
					I	II	III	
100	8	0.25-0.40	14	5	brown	brown	blue	2322 553 01161
100	12	0.25-0.40	21	5	brown	red	black	01201
10	10	0.25-0.40	32	5	red	brown	grey	02181
10	15	0.25-0.40	48	5	red	red	red	02221
10	22	0.21-0.35	60	5	red	red	blue	02261
10	33	0.18-0.25	85	5	red	orange	black	02301
10	47	0.18-0.25	130	5	red	orange	yellow	02341
10	68	0.18-0.25	180	5	red	orange	grey	02381
1	68	0.14-0.23	230	5	orange	orange	grey	03381
1	100	0.14-0.21	350	5.5	orange	yellow	red	03421
1	150	0.14-0.21	500	6.5	orange	yellow	blue	03461
1	220	0.14-0.21	750	7.5	orange	green	black	03501
1	330	0.14-0.21	1100	9	orange	green	yellow	03541

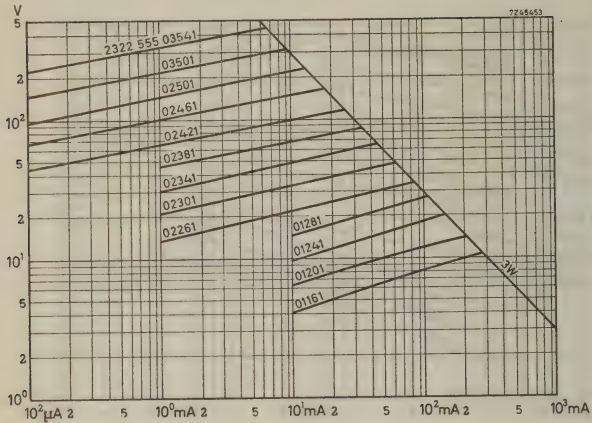
$W_{\max.} = 2 \text{ W}$
 $D_{\max.} = 27.5 \text{ mm}$



<i>I</i> (mA)	<i>E</i> (V)	β	<i>C</i> approx.	$l_{\max.}$ (mm)	colour code			catalog number
					<i>I</i>	<i>II</i>	<i>III</i>	
100	10	0.25–0.40	18	5	brown	brown	grey	2322 554 01181
100	15	0.25–0.40	26	5	brown	red	red	01221
10	12	0.25–0.40	38	5	red	red	black	02201
10	18	0.21–0.35	57	5	red	red	yellow	02241
10	27	0.21–0.35	70	5	red	red	grey	02281
10	39	0.18–0.25	97	5	red	orange	red	02321
10	56	0.18–0.25	140	5	red	orange	blue	02361
10	82	0.14–0.23	170	5	red	yellow	black	02401
10	120	0.14–0.21	250	5	red	yellow	yellow	02441
10	180	0.14–0.21	380	6	red	yellow	grey	02481
1	180	0.14–0.21	540	7	orange	yellow	grey	03481
1	270	0.14–0.21	810	8	orange	green	red	03521

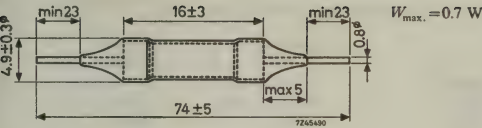
VOLTAGE DEPENDENT RESISTORS

$W_{max.} = 3 \text{ W}$
 $D_{max.} = 42.5 \text{ mm}$

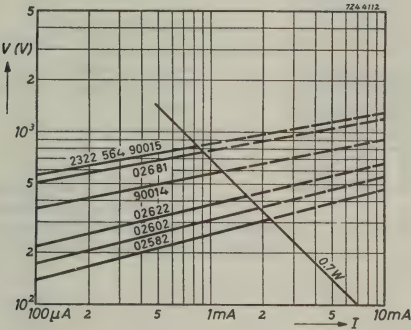


I (mA)	E (V)	β	C approx.	$l_{max.}$ (mm)	colour code			catalog number
					I	II	III	
100	8	0.25-0.40	14	5	brown	brown	blue	2322 555 01161
100	12	0.25-0.40	21	5	brown	red	black	01201
100	18	0.25-0.40	32	5	brown	red	yellow	01241
100	27	0.25-0.40	48	5	brown	red	grey	01281
10	22	0.21-0.35	60	5	red	red	blue	02261
10	33	0.18-0.25	84	5	red	orange	black	02301
10	47	0.18-0.25	125	5	red	orange	yellow	02341
10	68	0.18-0.25	175	5	red	orange	grey	02381
10	100	0.14-0.23	210	5	red	yellow	red	02421
10	150	0.14-0.21	320	5.5	red	yellow	blue	02461
10	220	0.14-0.21	460	6.5	red	green	black	02501
1	220	0.14-0.21	660	7.5	orange	green	black	03501
1	330	0.14-0.21	980	9	orange	green	yellow	03541

Standard rod types



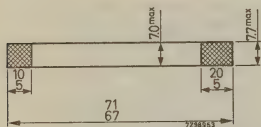
<i>I</i> (mA)	<i>E</i> (V)	β	colour code	catalog number
10	$470 \pm 10 \%$	0.20–0.25	green	2322 564 02582
10	$560 \pm 10 \%$	0.18–0.23	blue	02602
10	$680 \pm 10 \%$	0.18–0.23	violet	02622
10	$910 \pm 10 \%$	0.18–0.23	white	90014
10	$1200 \pm 20 \%$	0.17–0.22	grey	02681
10	$1300 \pm 10 \%$	0.16–0.21	red	90015
1	$300 \pm 20 \%$	0.18–0.25	yellow	90016
2	$950 \pm 10 \%$	0.16–0.21	black/blue	90005



VOLTAGE DEPENDENT RESISTORS

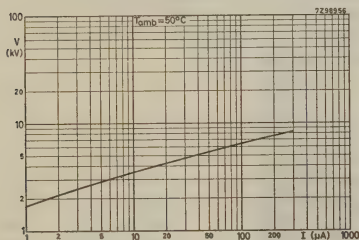
Rod type without leads, 2322 564 92003

For focus tracking in line time-base circuits of colour television sets.



Measurements and ratings are given at an ambient temperature of $+50^{\circ}\text{C} + 2^{\circ}\text{C}$ unless otherwise stated.

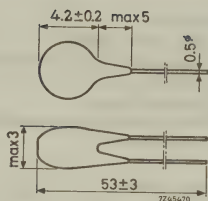
Current at $V_{d.c.} = 7 \text{ kV}$	100 to 150 μA
Maximum current	175 μA
β -value between 4 kV and 7 kV	0.17 to 0.25
Dissipation factor	22 mW/deg C
Operating temperature range	
at zero power	-25 to $+125^{\circ}\text{C}$
at max. power	0 to $+50^{\circ}\text{C}$



small disc types

or use in colour television

<i>I_A</i>	<i>E</i> (V)	tolerance on voltage	catalog number
	6	±20%	2322 565 90002
	9	±20%	90003
	12	±15%	90004
	15	±15%	90005
	18	±12%	90006



symmetric types

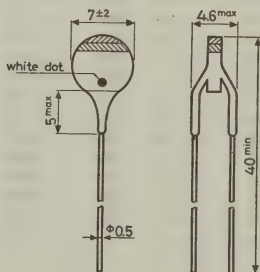
<i>T_{amb}</i> = 25°C		catalog number	
		2322 574 90001	2322 574 90002
forward direction	voltage at 1 mA	1.0 V ± 10%	1.35 V ± 10%
	temp. coeff.	> -0.2%/deg C	> -0.2%/deg C
	β	0.05-0.08	0.06-0.09
	capacitance at 0 mA	~0.15 μ F	~0.15 μ F
	at 5 mA	~10 μ F	~10 μ F
	max. permissible current	25 mA	20 mA
reverse direction	current at 5 V	< 2 μ A	< 2 μ A
	capacitance at 0 V	~0.15 μ F	~0.15 μ F
	at 5 V	~0.05 μ F	~0.05 μ F
	max. permissible voltage	5 V	5 V

temperature range: -30 to +70°C

thode is indicated by a white dot.

colour code 2322 574 90001 black and brown band

2322 574 90002 black and red band



VOLTAGE DEPENDENT RESISTORS

Disc types for contact protection

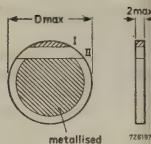
Marking

Discs without leads:

white colourband, (II) colour dot (I) indicates 10th digit of catalog number.

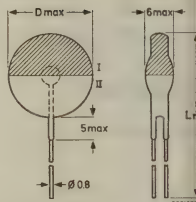
Discs with leads:

body colour (II) white, colourband (I) indicates 10th digit of catalog number.



Colour code:

	$W_{max.}$ (W)	$L_{min.}$	Catalog number prefix	Additional marking
0 = black				
1 = brown				
2 = red				
3 = orange	0.25	58.5	2322 575	VAP3
4 = yellow	0.40	62	2322 576	VAP2
5 = green	1.0	65	2322 577	VAP1
6 = blue				



These VDR's are developed for contact protection of relays in telephone exchanges.

$V_{d.c.}$ (V)	I (mA)	V_{pulse} (V)	I (mA)	$W_{max.}$ (W)	$D_{max.}$ (mm)	catalog number suffix	
						without leads	with leads
48	< 1.7	150	> 52	0.25	9.5	30272	00272
48	< 3	150	> 72	0.25	9.5	30372	00372
48	< 5	150	> 121	0.25	9.5	30472	00472
48	< 0.5	150	> 27	0.4	12.5	30072	00072
48	< 0.9	150	> 34	0.4	12.5	30172	00172
48	< 1.7	150	> 65	0.4	12.5	30272	00272
48	< 3	150	> 91	0.4	12.5	30372	00372
48	< 5	150	> 152	0.4	12.5	30472	00472
48	< 0.5	150	> 42	1	17	30072	00072
48	< 0.9	150	> 76	1	17	30172	00172
48	< 1.7	150	> 115	1	17	30272	00272
48	< 3	150	> 180	1	17	30372	00372
48	< 5	150	> 268	1	17	30472	00472
48	< 9	150	> 430	1	17	30572	00572
48	< 15	150	> 455	1	17	30672	00672

LIGHT DEPENDENT RESISTORS

The light dependent resistors are virtually small photoconductive cells, provided with two tinned copper connecting leads.

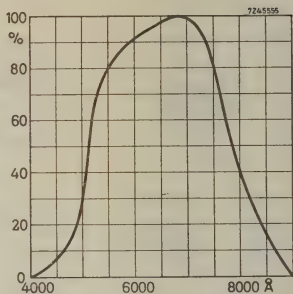
The relationship between resistance value and illumination can be expressed with good approximation by the formula :

$$R = AL^{-\alpha}$$

where R = resistance value in Ω

L = illumination in lux

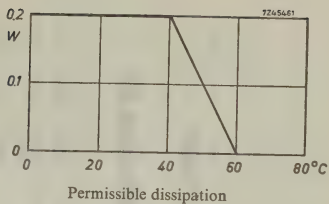
A and α are constants



Spectral response characteristic of an LDR

Electrical performance

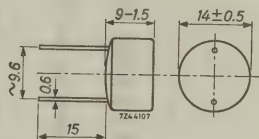
dark value	$> 10 \text{ M}\Omega$
light value	$75\text{--}300 \text{ }\Omega$ (measured at 1000 lux)
recovery rate	$> 200 \text{ k}\Omega/\text{s}$
permissible voltage	$150 \text{ V}_{\text{peak}}$
capacitance	$< 6 \text{ pF}$



Three versions are available differing mainly in shape and coating.

Version 2322 600 95001

Encapsulated in plastic case and synthetic resin
Ambient temperature range -20 to $+60^\circ\text{C}$



Version 2322 600 93001

This cell is sealed by means of a plastic coating
Ambient temperature range -30 to $+60^\circ\text{C}$



Version 2322 600 94001

This cell is covered with lacquer.
Ambient temperature range -30 to $+60^\circ\text{C}$



STANDARD SERIES OF VALUES IN A DECADE

E192	E96	E48	E192	E96	E48	E192	E96	E48	E192	E96	E48	E192	E96	E48	E192	E96	E48	E192	E96	E48
100	100	100	169	169	169	284	287	287	481	487	487	816	825	825	816	825	825	816	825	825
101			172	172		287			487			825			487			825		
102	102		174	174		291			493			835			493			835		
104			176	176		294			499			845			499			845		
105	105	105	178	178	178	298			505			856			505			856		
106			180	180		301		301	511	511	511	866		866	511	511	511	866		866
107	107		182	182		305			517			876			517			876		
109			184	184		309		309	523	523	523	887		887	523	523	523	887		887
110	110	110	187	187	187	312			530			898			530			898		
111			189	189		316		316	536	536	536	909		909	536	536	536	909		909
113	113		191	191		320			542			920			542			920		
114			193	193		324		324	549	549	549	931		931	549	549	549	931		931
115	115	115	196	196	196	328			556			942			556			942		
117			198	198		332		332	562	562	562	953		953	562	562	562	953		953
118	118		200	200	200	336			569			965			569			965		
120			203	203		340		340	576	576	576	976		976	576	576	576	976		976

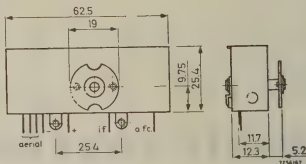
											E6			
											E24	E12	E6	
123											10	10	10	
124	124	208	210	210							11			
126		213									12	12		
127	127	215	215	215							13			
129		218									612			
130	130										619	619		
132		221	221								626			
133	133	223									634	634		
135		226	226	226							642			
137	137	229									649	649		
138		232	232								657			
140	140	234									665	665		
142		237	237	237							673			
143	143	240									681	681		
145		243	243								690			
147	147	246									698	698		
149		249	249	249							706			
150	150	252									715	715		
152		255	255								723			
154	154	258									732	732		
156		261	261	261							741			
158	158	264									750	750		
160		267	267								759			
162	162	271									768	768		
164		274	274	274							777			
165	165	277									787	787		
167		280	280								796			
											806	806		
											82	82		
											91			
											68	68		
											75			
											82	82		
											91			

F.M. TUNERS

F.M. tuners AP2151/..

<i>type</i>	<i>catalog number</i>
AP2151/00, F.M. tuner for European band	3122 108 68870
AP2151/01, F.M. tuner for American band	3122 107 13430

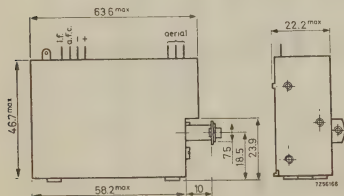
Supply voltage : 9 V_{d.c.}
 Frequency range
 AP2151/00 : 87–104 MHz
 AP2151/01 : 87–108 MHz
 Total gain AP2151/00 : 4.5 ×
 AP2151/01 : 4 ×
 Intermediate frequency : 10.7 MHz



F.M. tuners AP 2152/..

<i>type</i>	<i>catalog number</i>
AP2152/00, F.M. tuner for European band ; with soldering lugs	3122 108 69400
AP2152/01, as AP2152/00, but with pins for printed-wiring connection	3122 108 81760
AP2152/02, F.M. tuner for American band ; with soldering lugs	3122 108 68730

Supply voltage : 14 V_{d.c.}
 Frequency range
 AP2152/00 and AP2152/01 : 87–104 MHz
 AP2152/02 : 87–108.9 MHz
 Total gain : 4 ×
 Intermediate frequency : 10.7 MHz



F.M. tuners with diode tuning AP 2153/...

<i>type</i>	<i>catalog number</i>
AP2153/01, F.M. tuner for European band	3122 108 86460
AP2153/02, F.M. tuner for American band	3122 108 89640

Supply voltage : 15 V_{d.c.}

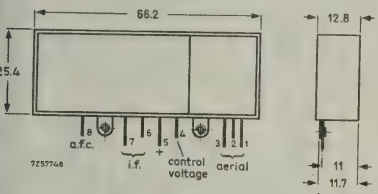
Frequency range

AP2153/01 : 87–105 MHz

AP2153/02 : 87–108 MHz

Total gain : 4 ×

Intermediate frequency : 10.7 MHz



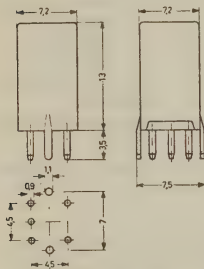
COILS FOR TRANSISTORISED RADIO RECEIVERS

7 × 7 Filter coils

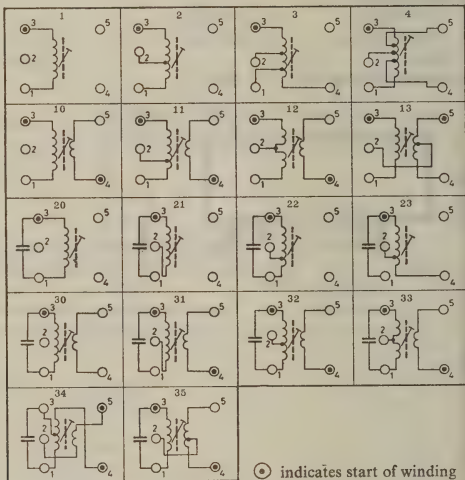
7 × 7 mm filter coils find application as i.f. single circuits and band-pass filters and as preselector and oscillator circuits in radio and television receivers, and also as input and output coils in hybrid filters.

A great number of standard coils are available, all colour coded.

Dimensions in mm



Standard circuits



Some examples of the standard types

Primary I.F. coil, circuit 32, $f=0.46$ MHz, $L=1150$ μ H, $Q=125$; 185/95/3 turns, capacitor = 100 pF, colour code black/violet, catalog number 3112 348 20070.

I.F. coil, circuit 10, $f=10.7$ MHz, $L=2.03$ μ H, $Q=104$; 14/1 turns, external capacitor 110 pF, colour code red/yellow, catalog number 3112 348 20240.

R.F. coil, circuit 2, $f=27.12$ MHz, $L=1.63$ μ H; 17/7 turns, external capacitor 17 pF, colour code yellow/red, catalog number 3112 348 20420.

Piezoelectric ceramic resonators for A.M. receivers

resonant frequency (kHz) ± 1 kHz	capacitance at 100 kHz (pF)	catalog number versions according to fig. 1	2422 540 versions according to fig. 2
452	190	00101	00201
455	180	00102	00202
460	180	00103	00203
468	180	00104	00204
470	180	00105	00205

Quality factor

: > 800

Inductance

: 8.5 mH

Ambient temperature range

: -25 to +85°C

Temperature coefficient of

resonant frequency

: $< 85 \cdot 10^{-6}/\text{deg C}$

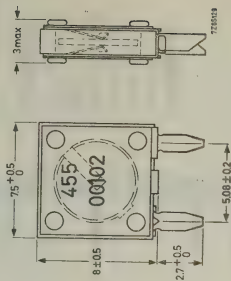


Fig. 1. Version for printed-wiring boards, with holes of 1.3 mm

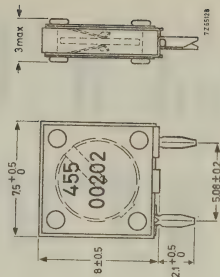


Fig. 2. Version for printed-wiring boards with holes of 0.8 mm

LOUDSPEAKERS

Standard range, round cone

width (mm) × height (mm)	depth (mm)	max. power	resonance frequency	impedance	catalogue number	type number	main applications
2½ in				4 Ω	2422 257 23801	AD2070/Z4	
64 mm Ø	20	0.5 W	360 Hz	8 Ω	2422 257 23802	Z8	portable sets
				15 Ω	2422 257 23803	Z15	intercom
				25 Ω	2422 257 23804	Z25	
3 in				4 Ω	2422 257 23701	AD3070/Y4	
81 mm Ø	28	1 W	250 Hz	8 Ω	2422 257 23702	Y8	portable sets
				15 Ω	2422 257 23703	Y15	intercom
				25 Ω	2422 257 23704	Y25	
81 × 81	28	1 W	250 Hz	150 Ω	2422 257 23705	AD3370/Y150	
4 in				4 Ω	2422 257 24201	AD4070/Y4	
105 mm Ø	29	1 W	200 Hz	8 Ω	2422 257 24202	Y8	portable sets
				15 Ω	2422 257 24203	Y15	
				25 Ω	2422 257 24204	Y25	
105 mm Ø	39	3 W	165 Hz	4 Ω	2422 257 34301	AD4080/X4	
			165 Hz	8 Ω	2422 257 34302	X8	portable sets
			165 Hz	15 Ω	2422 257 34303	X15	
			165 Hz	25 Ω	2422 257 34304	X25	
			185 Hz	4 Ω	2 22 257 34305	Z4	
			185 Hz	8 Ω	2422 257 34306	Z8	
			185 Hz	15 Ω	2422 257 34307	Z15	
			185 Hz	25 Ω	2422 257 34308	Z25	

portable sets,
televisionAD4050/X4
X15
X4002422 256 34302
2422 256 3430315 Ω
400 Ω 190 Hz
190 Hz2 W
0.6 W

37

105 mm \varnothing

5 in

{	4 Ω	{	155 Hz	{	2422 257 35201	{	AD5080/Z4
	8 Ω				2422 257 35202		Z8
	15 Ω				2422 257 35203		Z15
	25 Ω				2422 257 35204		Z25
{	4 Ω	{	130 Hz	{	2422 257 35205	{	radio
	8 Ω				2422 257 35206		tape recorders
	15 Ω				2422 257 35207		X4
	25 Ω				2422 257 35208		X8
{	4 Ω	{	130 Hz	{	2422 257 35209	{	record players
	8 Ω				2422 257 35211		intercom
	15 Ω				2422 257 35212		car radios
	25 Ω				2422 257 35213		X15

129 mm \varnothing

6 W

48

6½ in

{	110 Hz	{	2422 257 37801	{	AD7080/X4
	110 Hz		2422 257 37802		X8
{	105 Hz	{	2422 257 37803	{	radio
	105 Hz		2422 257 37804		tape recorders

166 mm \varnothing 6 W
4 W

56

{	115 Hz	{	2422 256 37005	{	AD7091/X4
	95 Hz		2422 256 37004		M4
	115 Hz		2422 256 37002		X800
	95 Hz		2422 256 37001		M800
	115 Hz		2422 256 37008		X8
{	95 Hz	{	2422 256 37009	{	M8
	8 Ω		television		

166 mm \varnothing

3 W

47

8 in

{	95 Hz	{	2422 257 38201	{	AD8080/X4
	95 Hz		2422 257 38202		X8
	75 Hz		2422 257 38203		M4
	75 Hz		2422 257 38204		M15

206 mm \varnothing

6 W

68

radio
television

LOUDSPEAKERS

Standard range, oval cone

width (mm) × height (mm)	depth (mm)	max. power	resonance frequency	impedance	catalogue number	type number	main applications
3 in × 5 in							
76 × 131	42	2 W	200 Hz	4 Ω 50 Ω 400 Ω 8 Ω 15 Ω	2422 256 30301 2422 256 30302 2422 256 30303 2422 256 30304 2422 256 30305	AD3590/X4 X50 X400 X8 X15	portable sets television
3 in × 8 in							
82 × 205	50	2 W	130 Hz	4 Ω 8 Ω 15 Ω	2422 257 30301 2422 257 30302 2422 257 30303	AD3880/X4 X8 X15	television tape recorders portable sets
82 × 205							
	54	2 W	$\left\{ \begin{array}{l} 120 \text{ Hz} \\ 120 \text{ Hz} \\ 125 \text{ Hz} \end{array} \right\}$	4 Ω 8 Ω 800 Ω	2422 256 30501 2422 256 30503 2422 256 30502	AD3890/X4 X8 X800	radio, colour television
4 in × 6 in							
		$\left\{ \begin{array}{l} 3 \text{ W} \end{array} \right\}$	$\left\{ \begin{array}{l} 155 \text{ Hz} \end{array} \right\}$	$\left\{ \begin{array}{l} 4 \Omega \\ 8 \Omega \\ 15 \Omega \\ 25 \Omega \end{array} \right\}$	2422 257 30201 2422 257 30202 2422 257 30203 2422 257 30204	AD4680/Z4 Z8 Z15 Z25	radio tape recorders record players
		$\left\{ \begin{array}{l} 6 \text{ W} \end{array} \right\}$	140 Hz	$\left\{ \begin{array}{l} 4 \Omega \\ 8 \Omega \\ 15 \Omega \\ 25 \Omega \end{array} \right\}$	2422 257 30205 2422 257 30206 2422 257 30207 2422 257 30208	X4 X8 X15 X25	
103 × 154	48			$\left\{ \begin{array}{l} 4 \Omega \\ 8 \Omega \\ 15 \Omega \end{array} \right\}$	2422 257 30209 2422 257 30211 2422 257 30212	M4 M8 M15	
				$\left\{ \begin{array}{l} 125 \text{ Hz} \end{array} \right\}$	2422 257 30213	M25	
		$\left\{ \begin{array}{l} 4 \text{ W} \end{array} \right\}$		25 Ω			

103 × 154	51	4 W	135 Hz	<div> <div>800 Ω</div> <div>4 Ω</div> <div>4 Ω</div> <div>8 Ω</div> </div>	<div> 2422 256 30103 2422 256 30104 2422 256 30105 2422 256 30106 </div>	<div> M800 M4 X4 M8 </div>
-----------	----	-----	--------	--	---	---

5 in × 7 in						AD5780/X4	radio tape recorders records players car radios
134 × 184	58	<div><div>3 W</div><div>4 W</div></div>	<div><div>115 Hz</div><div>100 Hz</div></div>	<div><div>4 Ω</div><div>8 Ω</div><div>15 Ω</div><div>25 Ω</div><div>4 Ω</div><div>8 Ω</div><div>15 Ω</div><div>25 Ω</div></div>	<div><div>2422 257 36101</div><div>2422 257 36102</div><div>2422 257 36103</div><div>2422 257 36104</div><div>2422 257 36105</div><div>2422 257 36106</div><div>2422 257 36107</div><div>2422 257 36108</div></div>	<div><div>AD5780/X4</div><div>X8</div><div>X15</div><div>X25</div><div>M4</div><div>M8</div><div>M15</div><div>M25</div></div>	
6 in × 9 in						AD6980/X4	radio record players
161 × 234	68	6 W	<div><div>90 Hz</div><div>90 Hz</div><div>77 Hz</div><div>77 Hz</div></div>	<div><div>4 Ω</div><div>8 Ω</div><div>4 Ω</div><div>8 Ω</div></div>	<div><div>2422 257 39101</div><div>2422 257 39102</div><div>2422 257 39103</div><div>2422 257 39104</div></div>	<div><div>AD6980/X4</div><div>X8</div><div>M4</div><div>M8</div></div>	

LOUDSPEAKERS

Tweeters, woofers and squawkers for Hi-Fi equipment

width (mm) × height (mm)	depth. (mm)	max. power	resonance frequency	impedance	catalogue number	type number	main applications
1 in dome tweeters							
94 mm Ø	27	20 W	1000 Hz	4 Ω 8 Ω	2422 257 33001 2422 257 33002	AD0160/T4 T8	combinations
2½ in tweeters							
58 mm Ø	29	10 W ⁽¹⁾	< 800 Hz	4 Ω 8 Ω	2422 257 22001 2422 257 22002	AD2071/T4 T8	combinations
5 in squawkers							
129 mm Ø	107	40 W	210 Hz	4 Ω 8 Ω	2422 257 35401 2422 257 35402	AD5060/Sq4 Sq 8	combinations
5 in woofers							
129 mm Ø	56	10 W ⁽²⁾	50 Hz	4 Ω 8 Ω	2422 257 35301 2422 257 35302	AD5060/W4 W8	enclosures
7 in woofers							
166 mm Ø	74	20 W ⁽²⁾	28 Hz	4 Ω 8 Ω	2422 257 37702 2422 257 37701	AD7065/W4 W8	enclosures
8 in woofers							
206 mm Ø	93	20 W ⁽²⁾	28 Hz	4 Ω 8 Ω	2422 257 38102 2422 257 38101	AD8065/W4 W8	enclosures
10 in woofers							
261 mm Ø	152	40 W ⁽²⁾	20 Hz	4 Ω 8 Ω	2422 256 41201 2422 256 41202	AD1056/W4 W8	enclosures
12 in woofers							
315 mm Ø	169	40 W ⁽²⁾	15 Hz	4 Ω 8 Ω	2422 256 41301 2422 256 41302	AD1256/W4 W8	enclosures

5 in						
129 mm Ø	56	4 W	85 Hz	4 Ω 8 Ω	2422 257 35101 2422 257 35102	AD5060/M4 M8 enclosures
6½ in						
166 mm Ø	70	10 W	55 Hz	4 Ω 8 Ω	2422 257 37901 2422 257 37902	AD7061/M4 M8 enclosures
8 in						
205 mm Ø	95	10 W	70 Hz	4 Ω 8 Ω	2422 257 48001 2422 257 48002	AD8065/M4 M8 enclosures
8½ in						
217 mm Ø	116	10 W	50 Hz	7 Ω	2422 258 48002	9710M/01 enclosures
10 in						
261 mm Ø	113	10 W	55 Hz	4 Ω 8 Ω	2422 257 41001 2422 257 41002	AD1065/M4 M8 enclosures
12 in						
315 mm Ø	133	20 W	45 Hz	4 Ω 8 Ω	2422 257 41101 2422 257 41102	AD1265/M4 M8 enclosures
315 mm Ø	169	50 W	60 Hz	4 Ω 8 Ω	2422 256 51101 2422 256 51102	AD1256/HP4 HP8 guitar amplifiers electronic organs
315 mm Ø	169	25 W	45 Hz	4 Ω 8 Ω	2422 256 51001 2422 256 51002	AD1256/M4 M8 enclosures

1) With 5 μF in series of 8 Ω version and 12 μF of 4 Ω version.

2) In closed acoustic box.

LOUDSPEAKERS

Recommended loudspeaker combinations

<i>Woofer</i>	<i>Squawker</i>	<i>Tweeter</i>	<i>Enclosure volume</i>	<i>Power handling capacity</i>	<i>Cross-over frequencies</i>
AD5060/W	—	AD0160/T	3 l	10 W	1000 Hz
AD5060/W	—	AD2070/T	3 l	10 W	2000 Hz
AD7065/W	—	AD0160/T	7 l	20 W	1500 Hz
AD8065/W	—	AD0160/T	15 l	20 W	1500 Hz
AD8065/W	AD5060/W	AD0160/T	25 l	20 W	700 Hz, 3000 Hz
AD1055/W	AD5060/W	AD0160/T	35 l	40 W	700 Hz, 3000 Hz
AD1055/W	2 × AD5060/W	2 × AD0160/T	40 l	40 W	700 Hz, 3000 Hz
AD1256/W	2 × AD5060/W	2 × AD0160/T	50 l	40 W	700 Hz, 3000 Hz
AD1256/W	4 × AD5060/W	4 × AD0160/T	80 l	40 W	700 Hz, 3000 Hz

<i>size and shape (in)</i>	<i>magnet system¹⁾</i>	<i>version</i>	<i>impedance (Ω)</i>
01 = 1	round		
10 = 10	round	Z = Notably higher sensitivity around a response peak at about 3 kHz	
12 = 12	round	Y = Notably higher response level in the region 2 to 6 kHz	
20 = 2½ to 2½	round	X = Same as Y, but a wider frequency range	
30 = 3	round	M = Smooth response over wide frequency range	
33 = 3	square	W = Woofer, extremely low resonance frequency	
35 = 3 × 5	oval	T = Tweeter, high frequency range	
38 = 3 × 8	oval	HP = High power-handling capacity	
40 = 4	round	Sq = Squawker; for midrange frequencies	
44 = 4	square		
46 = 4 × 6	oval		
50 = 5	round		
57 = 5 × 7	oval		
69 = 6 × 9	oval		
70 = 6½	round		
80 = 8	round		

¹⁾ Mechanical or acoustical variations are indicated by replacing 0 or 5 by some other figure (91 = Sinterpot Wafer)

TELEVISION TUNERS

V.H.F./U.H.F. tuner AT7672/90

This tuner is fitted with a push-button unit. Up to six selections are possible, each of which may be pre-adjusted to any v.h.f. or u.h.f. channel.

Catalog number : 3122 108 65520

System : C.C.I.R.

Transistors, r.f. amplifier: AF239

mixer: AF139

oscillator: AF139

Supply, r.f. amplifier : +12 V (min. +9.5 V)

oscillator : +12 V (min. +9.5 V)

Total supply current

without a.g.c.: approx. 11 mA

with a.g.c.: approx. 17 mA

Frequency ranges : 47-68 MHz (band I)

174-230 MHz (band III)

470-890 MHz (bands IV and V)

Intermediate frequencies

picture: 38.9 MHz

sound: 33.4 MHz

Aerial impedance : 300 Ω , symmetrical

Gain for an i.f. bandwidth of

7 MHz at 3 dB

bands I and III : ≥ 22 dB (average value 26 dB)

bands IV and V : ≥ 18 dB (average value 24 dB)

Noise, band I : average value 5.5 dB (max. 7.0 dB)

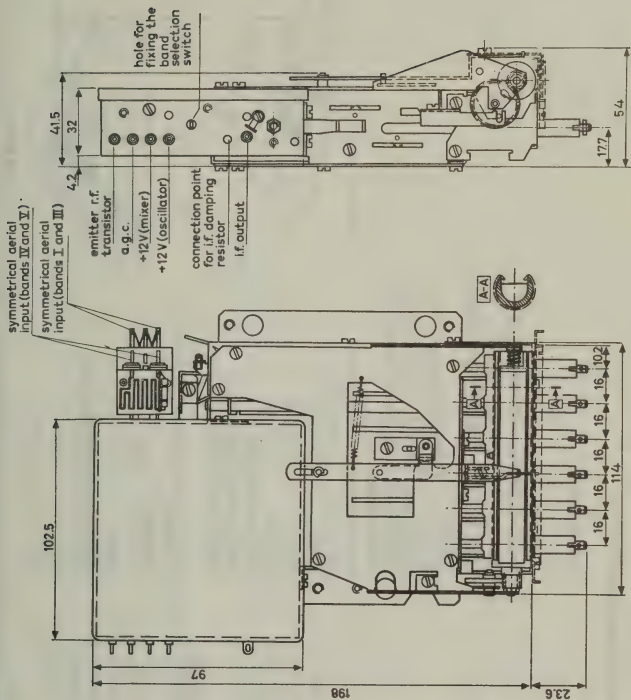
band III : average value 6 dB (max. 7.5 dB)

at 470 MHz : average value 6 dB (max. 9.0 dB)

at 650 MHz : average value 7 dB (max. 9.0 dB)

at 800 MHz : average value 8 dB (max. 10.0 dB)

at 860 MHz : average value 9.5 dB (max. 11.0 dB)



TELEVISION TUNERS

V.H.F./U.H.F. tuner with diode tuning ELC 1004

Catalog number

: 2422 542 10041

System

: C.C.I.R.

Semiconductors

band I

: $2 \times \text{BF196}$, BF194, $3 \times \text{BB105G}$ (triplet)

band III

: BF200, BF195, $3 \times \text{BB105B}$ (triplet)

bands IV and V

: BF180, BF181, $3 \times \text{BB105B}$ (triplet) BAX13

Supply voltage

: $-12 \text{ V} \pm 10\%$

A.G.C. voltage

: from -8.8 V (bands I, III, IV and V) for

nominal gain to -1.5 V (band I), -4 V

(band III) and -5 V (bands IV and V) for

minimum gain

: variable between $+3$ and $+28 \text{ V}$

without a.g.c.

with max. a.g.c.

: 10 mA 20 mA

: 10 mA 16 mA

: 12.5 mA 17 mA

: $47-68 \text{ MHz}$ (band I)

: $174-230 \text{ MHz}$ (band III)

$470-854 \text{ MHz}$ (bands IV and V)

Tuning voltages

Supply current

band I

band III

bands IV and V

Frequency ranges

Intermediate frequencies

picture

sound

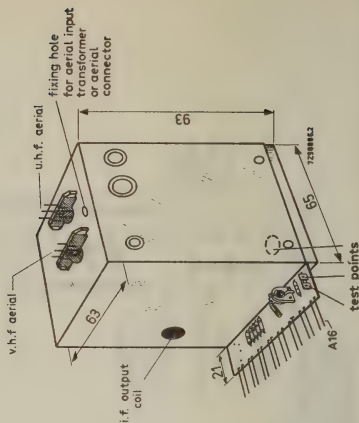
Aerial impedance

asymmetrical

symmetrical

: 75Ω

: 300Ω with input transformer



Gain with double tuned i.f. circuit, having a 3 dB bandwidth of 7 MHz and a dip of 0.5 dB

	<i>average</i>	<i>minimum</i>
band I	: 30 dB	27 dB
band III	: 32 dB	29 dB
band III	: 33 dB	30 dB
bands IV and V	: 27 dB	24 dB
channel 21	: 32 dB	29 dB
channel 50		

with single tuned i.f. circuit, having a 3 dB bandwidth of 3 MHz (v.h.f.) or about 4 MHz (u.h.f.)

	<i>average</i>	<i>minimum</i>
band I	: 35 dB	32 dB
band III	: 36 dB	33 dB
band III	: 37 dB	34 dB
bands IV and V	: 31 dB	28 dB
channel 21	: 36 dB	33 dB
channel 50		

Noise

	<i>average</i>	<i>maximum</i>
band I	: 6.5 dB	8.5 dB
band III	: 7.5 dB	9.5 dB
bands IV and V	: 9.0 dB	12.0 dB

TELEVISION TUNERS

V.H.F./U.H.F. tuner with diode tuning ELC 1024

Dimensions	: see ELC1004	
Catalog number	: 2422 542 10241	
System	: C.C.I.R.	
Semiconductors band I	: 2 × BF196, BF194, 3 × BB105 (triplet)	
band III	: BF200, BF195, 3 × BB105 (triplet)	
bands IV and V	: BF180, BF181, 3 × BB105B (triplet), BAX13	
Supply voltage	: - 12 V ± 10 %	
A.G.C. voltage	: from - 8.8 V (bands I, III, IV and V) for nominal gain to - 1.5 V (band I), - 4 V (band III) and - 5 V (bands IV and V) for minimum gain	
Tuning voltages	: variable between + 1.5 and + 28 V	
	<i>without a.g.c.</i>	<i>with max. a.g.c.</i>
Supply current band I	: 10 mA	: 20 mA
band III	: 10 mA	: 16 mA
bands IV and V	: 12.5 mA	: 17 mA
Frequency ranges	: 47- 88 MHz (band I) 174-230 MHz (band III) 470-854 MHz (bands IV and V)	
Intermediate frequencies picture	: 38.9 MHz	
sound	: 33.4 MHz	
Aerial impedance asymmetrical	: 75 Ω	
symmetrical	: 300 Ω, with input transformer	
Gain with double tuned i.f. circuit, having a 3 dB bandwidth of 7 MHz and a dip of 0.5 dB	<i>average</i>	<i>minimum</i>
band I channel B	: 30 dB	: 27 dB
band III channel D	: 32 dB	: 29 dB
band III channel H	: 33 dB	: 30 dB
bands IV and V channel 21	: 27 dB	: 24 dB
channel 50	: 32 dB	: 29 dB

Gain with single tuned i.f. circuit, having a 3 dB bandwidth of 3 MHz (v.h.f.) or about 4 MHz (u.h.f.)

	<i>average</i>	<i>minimum</i>
band I channel B	: 35 dB	: 32 dB
band III channel D	: 36 dB	: 33 dB
band III channel H	: 37 dB	: 34 dB
bands IV and V channel 21	: 31 dB	: 28 dB
channel 50	: 36 dB	: 33 dB

Noise

	<i>average</i>	<i>maximum</i>
band I	: 7.0 dB	: 8.5 dB
band III channels D-H1	: 7.5 dB	: 9.5 dB
bands IV and V channels 21-61	: 9.0 dB	: 12.0 dB

V.H.F./U.H.F. tuner with diode tuning ELC 1034

Dimensions	: see ELC1004		
Catalog number	: 2422 542 10341		
System	: Italian with italian i.f.		
Semiconductors band I	: 2 × BF196, BF194, 3 × BB105 (triplet)		
band III	: BF200, BF195, 3 × BB105 (triplet)		
bands IV and V	: BF180, BF181, 3 × BB105B (triplet), BAX13		
Supply voltage	: -12 V ± 10%		
A.G.C. voltage	: from -8.8 V (bands I, III, IV and V) for nominal gain to 1.5 V (band I), -4 V (band III) and -5 V (bands IV and V) for minimum gain		
Tuning voltages	: variable between +3 and +28 V without a.g.c. with max. a.g.c.		
Supply current band I	: 10 mA	20 mA	
band III	: 10 mA	16 mA	
bands IV and V	: 12.5 mA	17 mA	
Frequency ranges	: 52.5-88 MHz (band I) 174-230 MHz (band III) 470-854 MHz (bands IV and V)		
Intermediate frequencies picture	: 45.9 MHz		
sound	: 40.4 MHz		
Serial impedance asymmetrical	: 75 Ω		
symmetrical	: 300 Ω, with input transformer		
Gain with double tuned i.f. circuit, having a 3 dB bandwidth of 7 MHz and a dip of 0.5 dB			
		average	minimum
band I channel B	: 29 dB	26 dB	
band III channel D	: 31 dB	28 dB	
band III channel H	: 32 dB	29 dB	
bands IV and V channel 21	: 26 dB	23 dB	
channel 50	: 31 dB	28 dB	
Gain with single tuned i.f. circuit, having a 3 dB bandwidth of 3 MHz (v.h.f.) or about 4 MHz (u.h.f.)			
		average	minimum
band I channel B	: 31 dB	28 dB	
band III channel D	: 33 dB	30 dB	
band III channel H	: 34 dB	31 dB	
bands IV and V channel 21	: 28 dB	25 dB	
channel 50	: 33 dB	30 dB	
Noise			
		average	maximum
band I	: 7.0 dB	8.5 dB	
band III channels D-H1	: 7.5 dB	9.5 dB	
bands IV and V channels 21-61	: 9.0 dB	12.0 dB	

TELEVISION TUNERS

V.H.F./U.H.F. tuner with diode tuning ELC 1054

Dimensions	: see ELC1004	
Catalog number	: 2422 542 10541	
System	: French	
Semiconductors band I	: BF196, BF194, BF197, 3 × BB105 (triplet)	
band III	: BF200, BF195, 3 × BB105B (triplet), BA182, BAX13	
bands IV and V	: BF180, BF181, 3 × BB105B (triplet), BA182	
Supply voltage	: $-12\text{ V} \pm 10\%$	
A.G.C. voltage	: from -8.8 V (bands I, III, IV and V) for nominal gain to -1.5 V (band I), -4 V (band III) and -5 V (bands IV and V) for minimum gain	
Switching voltage, band III		
odd channels	: $+28\text{ V}$ (no load)	
even channels	: -12 V	
Tuning voltages	: variable between $+3$ and $+28\text{ V}$ without a.g.c. with max. a.g.c.	
Supply current band I	: 10.5 mA	20 mA
band III, odd channels	: 10 mA	16 mA
even channels	: 17 mA	23 mA
bands IV and V	: 13.5 mA	18 mA
Frequency ranges	: 41–68 MHz (band I) 162–215 MHz (band III) 470–854 MHz (bands IV and V)	
Intermediate frequencies		
v.h.f. picture	: 28.05 MHz	
sound	: 39.2 MHz	
u.h.f. picture	: 32.7 MHz	
sound	: 39.2 MHz	
Aerial impedance asymmetrical	: 75 Ω	
symmetrical	: 300 Ω , with input transformer	
Gain with double tuned i.f. circuit, having a 3 dB bandwidth of 12 MHz and a dip of 1 dB		
band I	: $\geq 25\text{ dB}$	band III, even channels : $\geq 26\text{ dB}$
channel F2	: 31 dB } average	channel F6 : 29 dB } average
channel F4	: 28 dB } values	channel F10 : 30 dB } values
band III, odd channels	: $\geq 22\text{ dB}$	bands IV and V : $\geq 24\text{ dB}$
channel F5	: 25 dB } average	channel 21 : 27 dB } average
channel F9	: 28 dB } values	channel 50 : 30 dB } values
Noise		
	average	maximum
band I	: 6.5 dB	8.5 dB
band III	: 8.5 dB	10.0 dB
bands IV and V channels 21–61	: 9.0 dB	12.0 dB

.H.F./U.H.F. tuner with diode tuning ELC 2000S

atalogue number	: 2422 542 12001	
ystem	: C.C.I.R.	
emiconductors		
bands I and III	: BF200, BF182, BF194, 4 × BB106, 5 × BA182	
bands IV and V	: BF180, BF181, 4 × BB105B	
upply voltage	: +12 V ± 10 %	
G.C. voltage		
band I, at nominal gain	: 2.4 V	
at 40 dB gain reduction	: 5.5 V, typical	
band III, at nominal gain	: 2.4 V	
at 40 dB gain reduction	: 4.5 V, typical	
bands IV and V, at nominal gain	: 2.4 V	
at 30 dB gain reduction	: 5.0 V, typical	
witching voltage		
band I	: open circuit	
band III	: +12 V	
bands IV and V	: +12 V	
uning voltage range	: +0.3 to +28 V	
upply current		
band I	: 14 to 21 mA	} depending on a.g.c. voltage
band III	: 34 to 41 mA	
bands IV and V	: 31.5 to 38.5 mA	
requency ranges		
band I	: channel 2 (picture carrier 48.25 MHz) to channel C (picture carrier 82.25 MHz).	
band III	: channel 5 (picture carrier 175.25 MHz) to channel 12 (picture carrier 224.25 MHz).	
bands IV and V	: channel 21 (picture carrier 471.25 MHz) to channel 69 (picture carrier 855.25 MHz).	
intermediate frequencies		
picture	: 38.9 MHz	
ound	: 33.4 MHz	
erial impedance, asymmetrical	: 75 Ω	
symmetrical	: 300 Ω	
ain		
nd I	: ≥ 26 dB	
channel 2	: 29 dB	} typical values
channel C	: 32 dB	
nd III	: ≥ 27 dB	
channel 5	: 31 dB	} typical values
channel 11	: 31 dB	
nds IV and V	: ≥ 25 dB	
channel 21	: 28 dB	} typical values
channel 51	: 32 dB	
channel 68	: 31 dB	

TELEVISION TUNERS

V.H.F./U.H.F. tuner with diode tuning ELC2000S (continued)

Noise figure

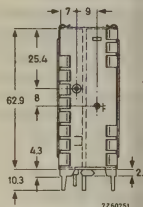
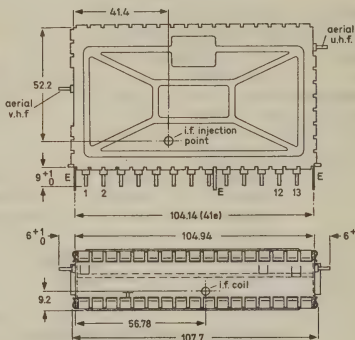
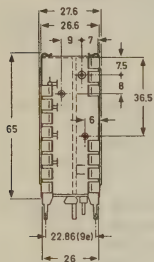
band I	: \leq 9 dB
channel 4	: 6 dB typical value
band III	: \leq 9 dB
channel 9	: 6 dB, typical value

bands IV channels 21 to 60 : \leq 12 dB

and V, channels 61 to 68 : \leq 13 dB

channel 21	: 9.5 dB
channel 51	: 10 dB
channel 68	: 11 dB

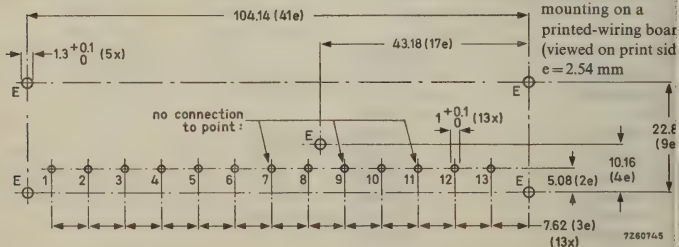
} typical value



Terminal

- 1 = a.g.c. voltage, v.h.f., +2.4 to +7.5 V
- 2 = tuning voltage, +0.3 to +28 V
- 3 = switching voltage, +12 V
- 4 = r.f. supply voltage, v.h.f., +12 V
- 5 = oscillator supply voltage, v.h.f., +12 V
- 6 = mixer supply voltage, v.h.f., +12 V
- 7 = test point 1, v.h.f.

- 8 = i.f. output
- 9 = test point 2 (alignment short)
- 10 = oscillator supply voltage, u.h.f., +12 V
- 11 = test point 3, u.h.f.
- 12 = r.f. supply voltage, u.h.f., +12 V
- 13 = a.g.c. voltage, u.h.f., +2.4 to +7.5 V
- E = earth



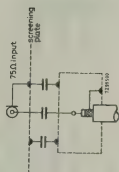
Coaxial aerial input assembly 75 Ω

Attenuation : ≤ 0.5 dB

Reflection, v.h.f. : $\leq 10\%$

u.h.f. : $\leq 25\%$

Catalogue number : 3122 127 10260



Coaxial aerial input assembly 75 Ω , with filter

Attenuation : ≤ 0.6 dB

Reflection, v.h.f. : $\leq 15\%$

u.h.f. : $\leq 30\%$

Frequency characteristic

v.h.f. : 350 MHz, - 3 dB

470 MHz, - 14 dB

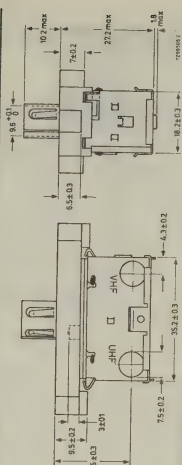
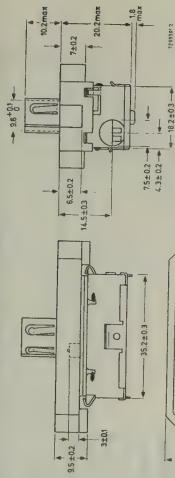
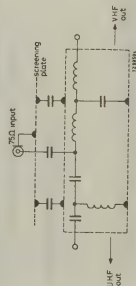
700 MHz, - 30 dB

u.h.f. : 400 MHz, - 3 dB

250 MHz, - 15 dB

100 MHz, - 40 dB

Catalogue number : 3122 127 10450



DEFLECTION COMPONENTS FOR BLACK AND WHITE TELEVISION

Deflection unit AT 1040

Catalogue number 3122 107 31380

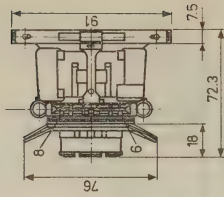
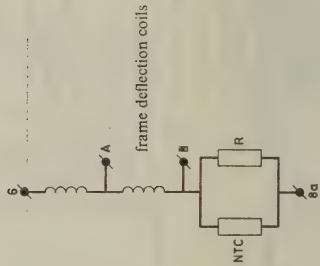
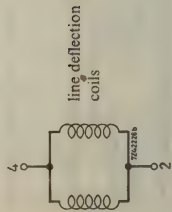
For use with a 110° picture tube with a neck diameter of 28 mm in conjunction with the AT 2036/10, AT 2036/37 and the AT 4042/02.

Line deflection coils, parallel connected

Inductance	2.1 mH
Resistance	3.9 Ω
Deflection current at 18 kV	2.82 A _{p-p}

Frame deflection coils, series connected

Inductance	66 mH
Resistance	30 Ω (6-8)
at 25°C	44 Ω (6-8a)
Deflection current	545 mA _{p-p}



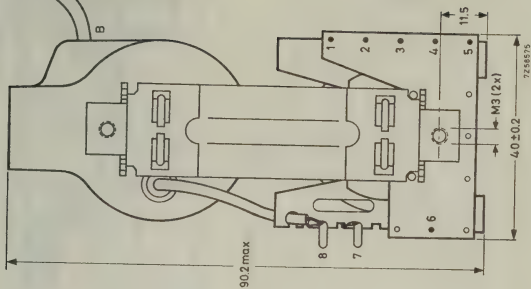
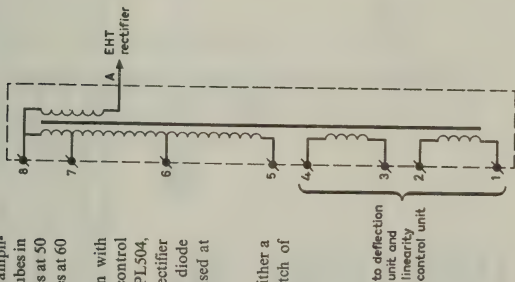
Order of contacts
8, 8a, 2, 4, A, 6

Catalogue number: 3122 138 30100

This line-output transformer has been developed to provide the required scanning amplitude for 17, 19, 20, 23 or 24 in picture tubes in television receivers presenting 625 lines at 50 frames per second (C.C.I.R.) or 525 lines at 60 frames per second (USA).

It is intended for use in conjunction with deflection unit AT 1040, linearity control unit AT 4042/02, line-output tube PL504, rectifying tube DY802 or selenium rectifier stack TV 18S or TV 20 and booster diode PY 88 or BY 147. The EHT is stabilised at 18 kV.

The transformer can be mounted on either a printed-wiring board (with a grid pitch of 2.54 or 2.50 mm) or on a metal chassis



mounting height = 66.5 mm
length A - B = 68 ± 3 mm

DEFLECTION COMPONENTS FOR BLACK AND WHITE TELEVISION

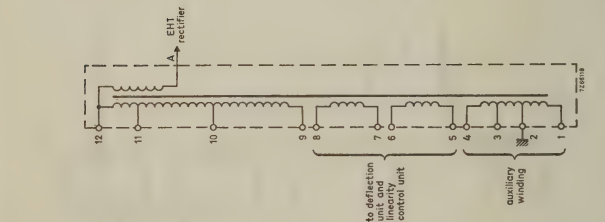
Line-output transformer AT 2036/37

Catalogue number: 3103 108 30170

This line-output transformer has been developed to provide the required scanning amplitude for 17, 19, 20, 23 or 24 in picture tubes in television receivers presenting 625 lines at 50 frames per second (C.C.I.R.) or 525 lines at 60 frames per second (USA).

It is intended for use in conjunction with deflection unit AT 1040, linearity control unit AT 4042/02, line-output tube PL504, rectifying tube DY802 or selenium rectifier stack TV 18S or TV 20 and booster diode PY 88 or BY 147. The EHT is stabilised at 18 kV.

The transformer can be mounted on either a printed-wiring board (with a grid pitch of 2.54 or 2.50 mm) or on a metal chassis



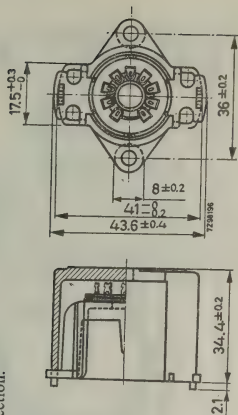
mounting height = 66.5 mm
length A - B = 68 ± 3 mm

Catalogue number: 3122 108 39450

For use in TV sets equipped with tubes, to adjust the linearity of the line deflection.
It can be used in combination with the AT 1040, AT 2036/10 or AT 2036/37.
For further data see section "Components for colour television".

E.H.T. tube sockets AT 7130 and AT 7130/01

These sockets for rectifier tube DY802 are equipped with a series resistor of 1.6Ω (AT 7130) or 1.2Ω (AT 7130/01) in the heater circuit.



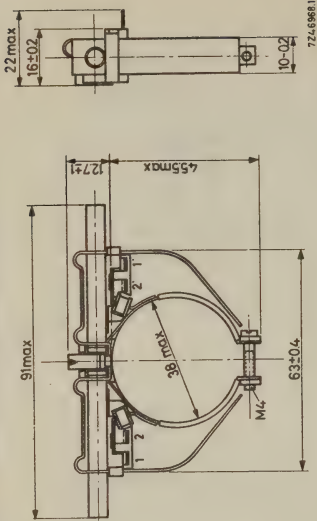
COMPONENTS FOR COLOUR TELEVISION

Blue lateral unit AT 1025/05
Catalogue number : 3122 107 30020
For use with a 90° shadow mask colour picture tube in conjunction with a deflection unit AT 1027/.. or AT 1029/.. and a convergence unit AT 4045/.. or AT 4046/.. or AT 4050/.. for static and dynamic lateral adjustment.

Coils, series connected (2 to 1')
Inductance 3.2 mH
Resistance 36 Ω

Coils, parallel connected (1 to 1' and 2 to 2')
Inductance 0.63 mH
Resistance 9 Ω

The unit must be positioned on the colour picture tube as close as possible to the convergence unit.

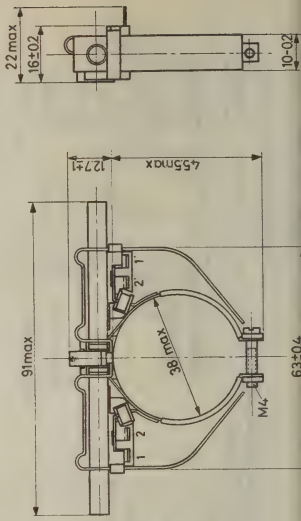


Blue lateral unit AT 1025/08
Catalogue number : 3122 137 11691

For use with a 90° shadow mask colour picture tube in conjunction with a deflection unit AT 1060/.. or AT 1062/.. and convergence unit AT 4045/.. or AT 4046/.. or AT 4050/.. for static and dynamic lateral adjustment.

Coils, parallel connected (1 to 1' and 2 to 2')
Inductance 0.3 mH
Resistance 3.2 Ω

The unit must be positioned on the colour picture tube as



Catalogue number : 3122 137 10990

For use with a 90°, 22 in or 26 in shadow mask colour picture tube, in conjunction with line-output transformer AT 2053/... or line-deflection transformer AT 2051/... and E.H.T. transformer AT 2052 and convergence unit AT 4045/... or AT 4046/... or AT 4050/..., blue lateral unit AT 1025/... or AT 1065/... or AT 1066/..., linearity control unit AT 4042/... and transductor AT 4041/...

Electrical data

Line deflection coils, parallel connected

Inductance

2.95 mH

Resistance at 25°C

2.9 Ω

Deflection current at 25 kV, edge to edge scan in both directions

2.6 A_{p-p}

Frame deflection coils, series connected

Inductance

114 mH

Resistance at 25°C

56 + 20*Ω

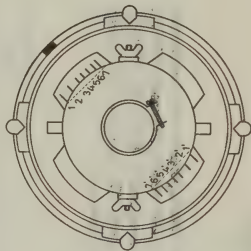
Deflection current at 25 kV, edge to edge scan in both directions

0.415 A_{p-p}

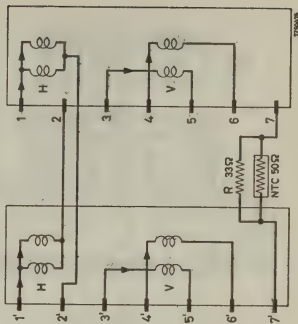
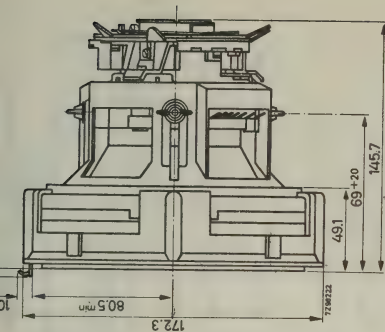
Maximum working temperature

95°C

* NTC thermistor in parallel with a resistor of 33 Ω



H = line coils
V = frame coils



COMPONENTS FOR COLOUR TELEVISION

Deflection unit AT 1027/09

Catalogue number 3122 107 31520

For use with a 90°, 22 in or 26 in shadow mask colour picture tube, in conjunction with line-output transformer AT 2053/... or line-deflection transformer AT 2051/... and E.H.T. transformer AT 2052, and convergence unit AT 4045/... or AT 4046/... or AT 4050/... blue lateral unit AT 1025/... or AT 1065/... or AT 1066, linearity control unit AT 4042/... and transductor AT 4041/...

Electrical data

Line deflection coils, parallel connected

Inductance

2.95 mH

Resistance at 25°C

2.9 Ω

Deflection current at 25 kV, edge to edge scan in both directions

2.6 Ap - p

Frame deflection coils, parallel connected

Inductance

28 mH

Resistance at 25°C

14 + 4¹⁾ Ω

Deflection current at 25 kV, edge to edge scan in both directions

0.83 Ap - p

Maximum working temperature

95°C

¹⁾ NTC thermistor in parallel with a resistor of 12 Ω.

Deflection unit AT 1029/07

Catalogue number 3122 108 87890

For use with a 90°, 19 in or 22 in shadow mask colour picture tube.

For further data see AT 1027/07.

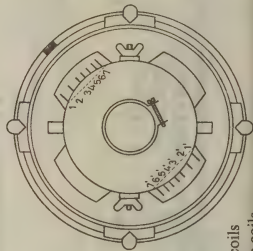
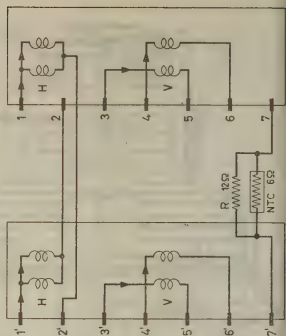
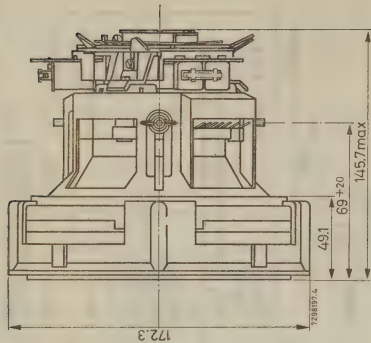
Deflection unit AT 1029/09

Catalogue number 3122 108 87900

For use with a 90°, 19 in or 22 in shadow mask colour picture tube.

For further data see AT 1027/09.

H = line coils
V = frame coils



Catalogue number 3122 137 10670

For use with a 110°, 26 in shadow mask colour picture tube A66-140X, in conjunction with convergence units AT 4045/... or AT 4046/... or AT 4050/..., E.H.T. and semi-scan transformer AT 2100/04 combined with modulated semi-scan transformer AT 2101/02 or line-output transformer AT 2057/... combined with a tripler, linearity control unit AT 4042/12 and blue lateral unit AT 1025/... or AT 1068/...

Electrical data

Line deflection coils, series connected

Inductance

4.4 mH

3.4 Ω

3.3 A p-p

Resistance at 25°C

Deflection current at 25 kV, edge to edge scan in both directions

Frame deflection coils, series connected

Inductance

25.4 mH

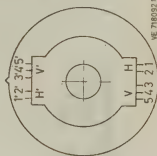
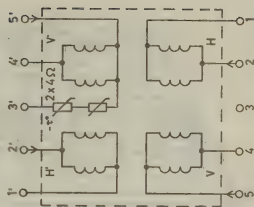
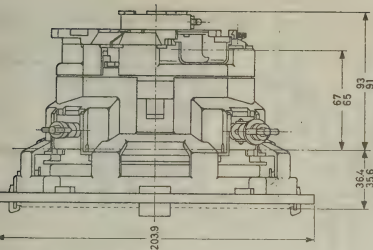
15 Ω +NTC (8 Ω)

1.2 A p-p

Deflection current at 25 kV, edge to edge scan in both directions

Maximum working temperature

95°C



COMPONENTS FOR COLOUR TELEVISION

Deflection unit AT 1062/01 (with purity ring AT 1061)

Catalogue number 3122 137 11720

For use with a 110°, 26 in shadow mask colour picture tube A66-140X, in conjunction with convergence units AT 4045/... or AT 4046/..., line-output transformer AT 2063/... combined with a tripler, linearity control unit AT 4042/12 and blue lateral unit AT 1025/... or AT 1068/...

Electrical data

Line deflection coils, series connected

Inductance

Resistance at 25°C

Deflection current at 25 kV, edge to edge scan in both directions

1.2 mH

3.7 Ω

5.8 A p-p

Frame deflection coils, series connected

Inductance

Resistance at 25°C

Deflection current at 25 kV, edge to edge scan in both directions

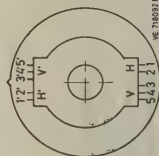
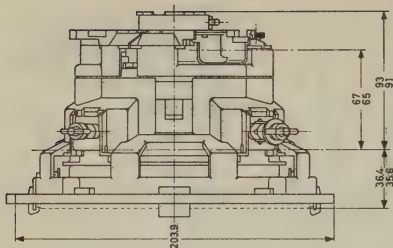
25 mH

15.5 Ω + NTC (8Ω)

1.12 A p-p

Maximum working temperature

95°C



VE 718032 P

For use with a 90° shadow mask colour picture tube in conjunction with a deflection unit AT 1027/.. or AT 1029/.., and convergence units AT 4045/.. or AT 4046/.. for static and dynamic lateral adjustment.

Static adjustment

Connection 1 and 3

Inductance

Resistance

200 mH
167 Ω

Dynamic adjustment

Connection 4 and 2

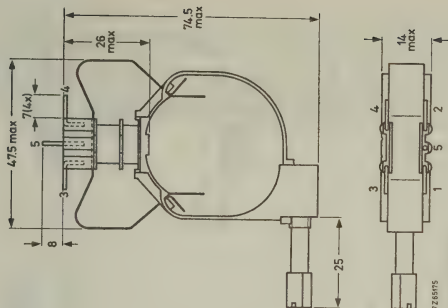
Inductance

Resistance

0.76 mH
1.2 Ω

Maximum working temperature 95°C.

The unit must be positioned on the colour picture tube as close as possible to the convergence unit.

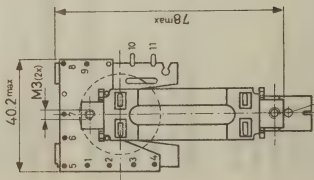


COMPONENTS FOR COLOUR TELEVISION

Line-deflection transformer AT 2051/00

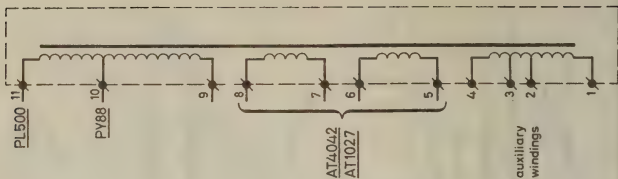
Catalogue number 3122 108 39390

This transformer has been designed to be used in combination with the E.H.T. transformer AT 2052/... to drive a colour picture tube with a deflection angle of 90° and an E.H.T. of 25 kV. It is intended for use in conjunction with deflection unit AT 1027/... or AT 1029/... linearity control AT 4042/..., transductor AT 4041/..., line-output tube PL500, focus voltage rectifier DY51 and booster diode PY88.



to secure tube socket
of focus rectifier

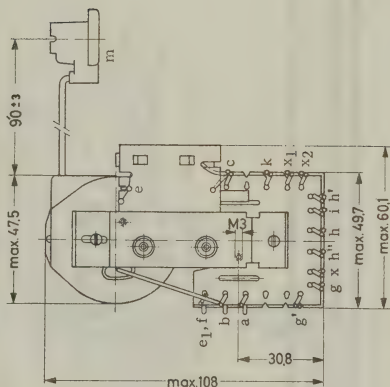
The transformer can be mounted on either a printed-wiring board
(with a grid pitch of 2.54 or 2.50 mm) or a metal chassis.
Mounting height 66.5 mm



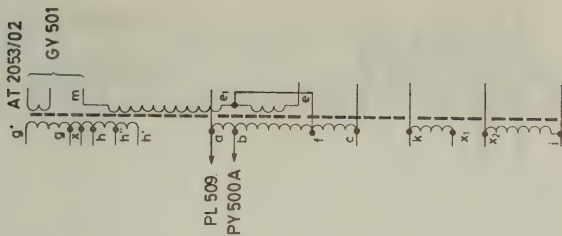
Catalogue number 3122 108 33920

For use with a 90° colour picture tube and deflection unit AT 1027/... or AT 1029/..., linearity control unit AT 4042/02, transducer AT 4041/..., line output tube PL509, booster diode PY500A, rectifier tube GY501.

The transformer can be mounted either on a printed-wiring board (with a grid pitch of 2.54 or 2.50 mm) or on a metal chassis.



Mounting height max. 85.5 mm



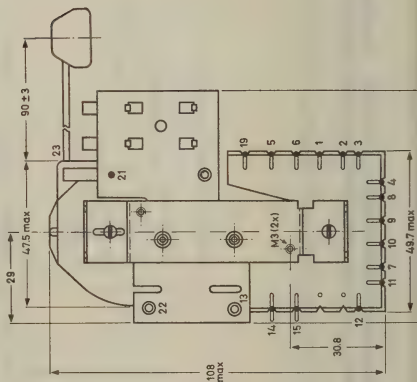
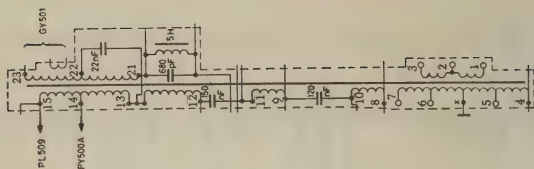
COMPONENTS FOR COLOUR TELEVISION

E.H.T. and semi-scan transformer AT 2100/04

Catalogue number 3122 138 30020

For use with modulated semi-scan transformer AT 2101/02 and modulation balancing coil AT 4040/31, deflection unit AT 1060/... line-output tube PL509, booster diode PY500A and rectifying tube GY501 to drive a 110° colour picture tube at an E.H.T. of 25 kV.

The transformer can be mounted either on a printed-wiring board (with a grid pitch of 2.54 or 2.50 mm) or on a metal chassis.

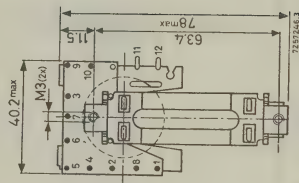


Mounting height max. 85.5 mm

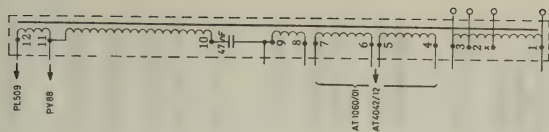
Catalogue number 3122 138 30380

For use with the E.H.T. and semi-scan transformer AT 2100/04 and the modulation balancing coil AT 4040/31 in conjunction with deflection unit AT 1060/... line output tube PL509 and booster diode PY88 to drive a 110° colour picture tube.

The unit can be mounted either on a printed-wiring board (with a grid pitch of 2.54 or 2.50 mm) or on a metal chassis.



Mounting height max. 66.5 mm

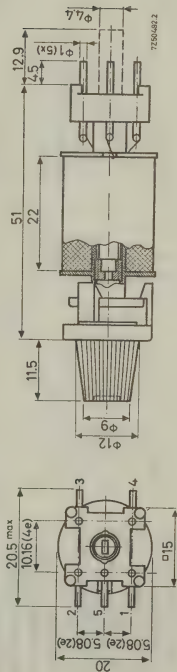
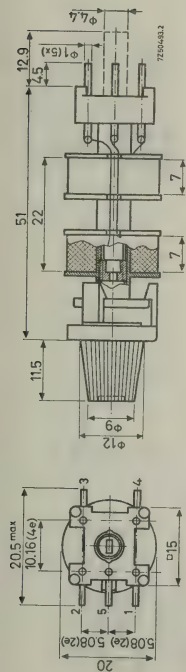


COMPONENTS FOR COLOUR TELEVISION

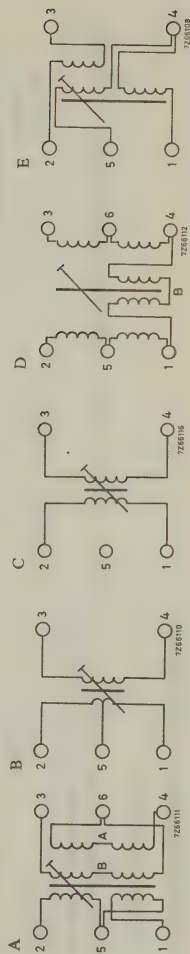
Convergence adjusters AT 4040/..

For use in conjunction with the convergence unit AT 4045/.., AT 4046/.. or AT 4050/.. for convergence adjustment.

<i>type number</i>	<i>circuit diagram</i>	<i>Fig.</i>	<i>terminals</i>	<i>L-range or L (mH)</i>	<i>d.c. resistance (Ω)</i>	<i>catalogue number</i>
AT 4040/35	A	1	1-5 2-5 3-4	0.17-0.07 0.07-0.17 0.05	0.48 0.48 0.18	3122 108 74390
AT 4040/44	B	2	3-4	15.6-3.0	11.5	3122 138 22870
AT 4040/49	C	1	3-4	1.06-0.33	2.4	3122 107 30030
AT 4040/53	B	2	1-2	0.33-1.06	2.4	
AT 4040/57	C	1	3-4	3.72-0.63	3.65	3122 107 30060
AT 4040/56	E	1	3-4	0.32-0.10	0.66	3122 107 30090
			1-2	0.10-0.32		
			4-5	0.024-0.006	0.11	3122 107 30080
			1-4	0.006-0.024	0.11	
			2-3	0.030-0.011	0.17	
AT 4040/58	C	1	3-4	8.15-2.5	20.7	3122 107 30100
			1-2	2.5-8.15		
AT 4040/61	B	2	3-4	33.5-7.2	23.1	3122 107 30130
AT 4040/63	C	1	3-4	0.44-0.11	1.35	3122 107 30480
				0.11-0.44	1.35	
AT 4040/89	C	1	1-2	4.5-12	25	3122 138 25770
			3-4	4.5-12	25	
AT 4040/92	D	1	3-4	0.07-0.22	0.65	3122 138 25780
			1-2	0.07-0.22	0.78	
			1-4	0.04	0.58	
AT 4040/93	C	1	1-2	0.21-0.58	1.05	3122 138 25790
			3-4	0.21-0.58	1.05	



Circuit diagrams



COMPONENTS FOR COLOUR TELEVISION

Correction coils AT 4040/...

The correction coils are mainly intended for use with the transductors AT 4041/... and the deflection units AT 1027/..., AT 1029/..., AT 1060/... and AT 1062... for raster correction.

<i>type number</i>	<i>circuit diagram</i>	<i>Fig.</i>	<i>terminals</i>	<i>L-range or L (mH)</i>	<i>d.c. resistance (Ω)</i>	<i>catalogue number</i>
AT 4040/31 bridge coil	A	1	3-4	1.1	0.82	3122 108 74400
AT 4040/32 phase adjuster	B	2	3-4	1.6-4	1.18	3122 108 74340
AT 4040/34 2nd harm/anti-S	A	1	3-4	0.03-0.1	0.18	3122 108 74410
AT 4040/36 balancing coil	A	3	3-4	0.08-0.56	0.22	3122 138 21090
AT 4040/38 2nd harm	C	1	1-2 3-4	1.17 0.033-0.13	6.5 0.33	3122 138 26320
AT 4040/50 amplitude adjuster	A	3	3-4	0.76-3.71	1.1	3122 107 31210
AT 4040/55 amplitude adjustor	A	3	3-4	246-11.5	4.1	3122 107 31220
AT 4040/85 balancing coil	D	4	1-2 3-4	0.03-0.1 0.03-0.1	0.23 0.23	3122 138 25750
AT 4040/87 phase adjuster	E	2	3-4	1.85 ± 20 %	2	3122 138 25760

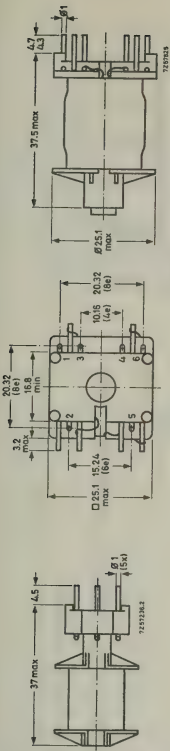


Fig. 1

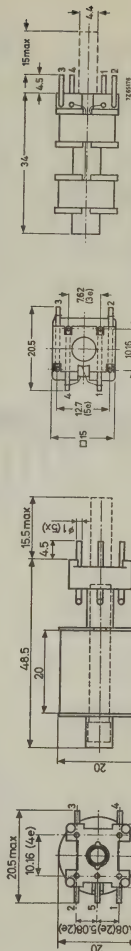


Fig. 2

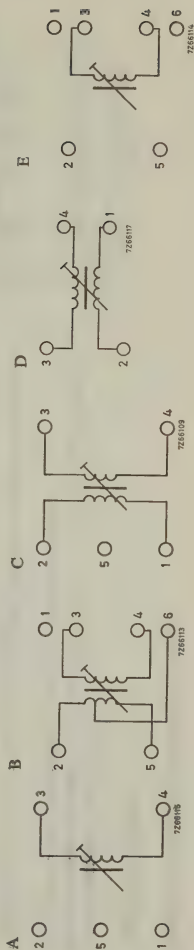


Fig. 4

Circuit diagrams

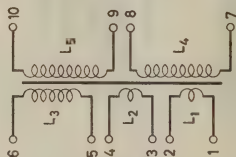
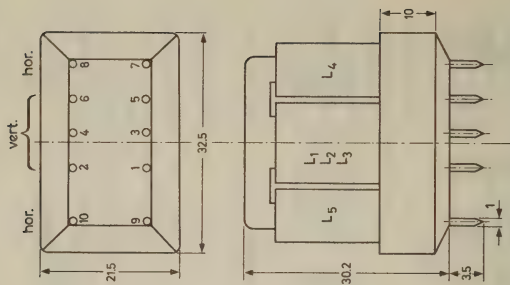
COMPONENTS FOR COLOUR TELEVISION

Transductor AT 4041/07

Catalogue number 3122 107 13410

For use in conjunction with the AT 1027/... or AT 1029/... or AT 2051/... and AT 4040/... and a frame-output transformer, to correct pin-cushion distortion.

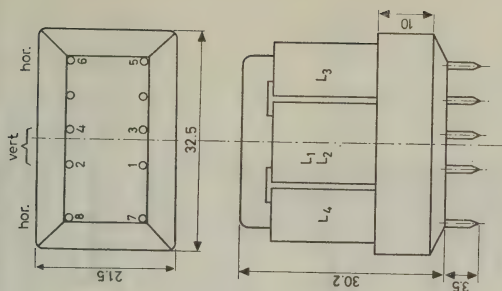
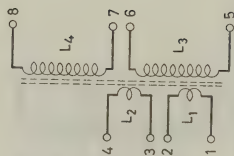
The transductor can be mounted on a printed-wiring board with grid pitch of 2.54 mm.



Catalogue number 3122 107 13420

For use in conjunction with the AT 1027/ .., AT 2051/ .., AT 4040/ .. and the frame-output transformer, to correct pin-cushion distortion.

The transducer can be mounted on a printed-wiring board with grid pitch of 2.54 mm.



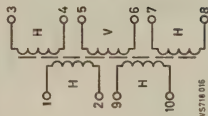
COMPONENTS FOR COLOUR TELEVISION

Transductor AT 4041/14

Catalogue number 3122 137 10530

For use in conjunction with the AT 1060/.. and in combination with AT 4041/15 for active E-W correction.

The transductor can be mounted on a printed-wiring board with grid pitch of 2.54 mm



H = Horizontal

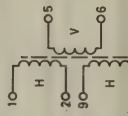
V = Vertical

Transductor AT 4041/15

Catalogue number 3122 137 10540

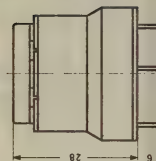
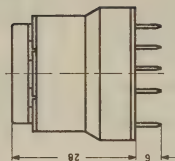
For use in conjunction with the AT 2057/.. and in combination with AT 4041/14 for active E-W correction.

The transductor can be mounted on a printed-wiring board with a grid pitch of 2.54 mm



H = Horizontal

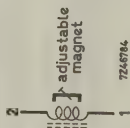
V = Vertical



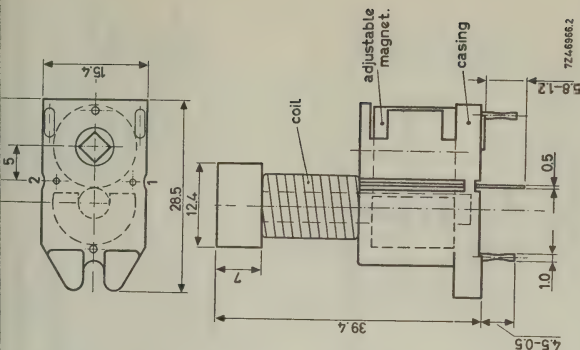
For use in colour TV sets equipped with tubes, to adjust the linearity of the line deflection. It can be used in combination with AT 1027/.. or AT 1029/.., and AT 2050/.. or AT 2051/.. or AT 2053/..

Electrical data

When a saw-tooth current (without S-correction) of $2.8 A_{p-p}$, frequency 15,625 Hz, flyback ratio 18%, flows through the linearity control unit (one connection point to earth), the correction voltage is adjustable between 15 V and 26 V.



7245784



Catalogue number 3122 138 26050

For use in the single-transistor (BU108) line-output circuit for the 110° colour television tube A66-140X.

The unit can be mounted on a printed-wiring board with a grid pitch of 2.54 mm or 2.50 mm

Electrical data

Inductance

Resistance

Max. voltage, p - p

Max. current, p - p

Max. current, r.m.s.

Max. working temperature

285 μ H \pm 10 %

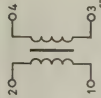
< 0.2 Ω

350 V

6 A

1.75 A

55°C



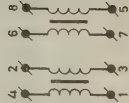
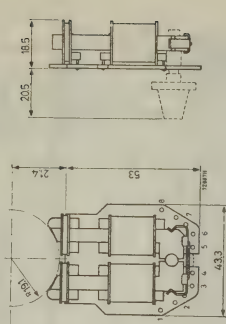
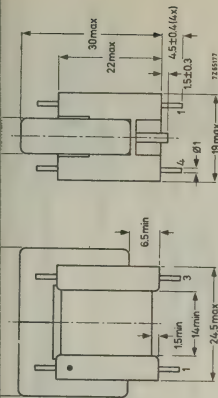
Convergence unit AT 4045/07, catalog number 3122 108 83130

Convergence unit AT 4046/07, catalog number 3122 108 83150

This unit is intended to be used with a 90° or 110° shadow mask colour picture tube, in conjunction with the deflection unit AT 1027/.. or AT 1029/.. or AT 1060/.. or AT 1062/.. to converge the three colour pictures statically and dynamically and to adjust the purity.

The AT 4046/07 has a permanent magnet for static convergence

Line coils		Frame coils	
Connections	Interconnection	in series	in parallel
		in series	in parallel
3 and 7	2 and 3	AT4045	AT4046
2-6	2-7	AT4045	AT4045
0.4	0.1 mH	1 and 5	1 and 5
2	0.5 Ω	4-8	4-8
		3-6	1-8
			4-5
			4-5
			0.34
			38.8
			48.5 Ω



COMPONENTS FOR COLOUR TELEVISION

Convergence unit AT 4045/08, catalogue number 3122 108 83140

Convergence unit AT 4046/08, catalogue number 3122 108 83160

This unit is intended to be used with a 90° or 110° shadow mask colour picture tube, in conjunction with the deflection unit AT 1027/... or AT 1029/... or AT 1060/... or AT 1062/... to converge the three colour picture statically and dynamically and to adjust the purity.

The AT 4046/07 has a permanent magnet for static convergence

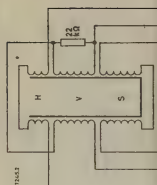
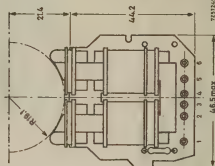
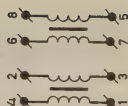
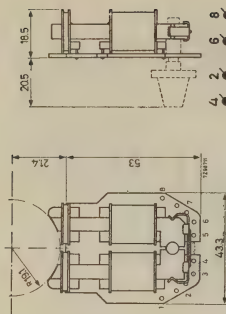
	Line coils		Frame coils	
	in series	in parallel	in series	in parallel
Connections	3 and 7	2 and 3	AT 4045	AT 4046
Interconnection	2-6	2-7 3-6	1 and 5 4-8	1 and 5 4-8
Inductance	4.9	1.2 mH	1.35	1.52
Resistance	22.6	7 Ω	155	194
				38.8
				0.38 H
				48.5 Ω

Convergence unit AT 4050/11

Catalogue number 3122 107 13220

This unit is intended to be used with a 110° shadow mask colour television picture tube, in conjunction with the deflection unit AT 1060/... or AT 1062/... to converge the three colour pictures statically and dynamically.

Line coils	Frame coils	Static coils	Series connected frame and static coils (2-6 inter-connected)
Connections 3-4	1-6	2-5	1-5



For use in the decoder circuits of television receivers.

Electrical data

Nominal frequency f_{nom} 4.433619 MHz

Nominal phase delay-time ($V_{in}-V_{out}$) at f_{nom} (unmodulated sine wave voltage) 63.943 μ s

Accuracy of adjustment ± 5 ns at 25°C

Bandwidth (–3 dB points) better than from 3.43 to 5.23 MHz

Insertion loss 11 ± 3 dB at f_{nom}

Temperature drift (relative to 25°C) phase delay

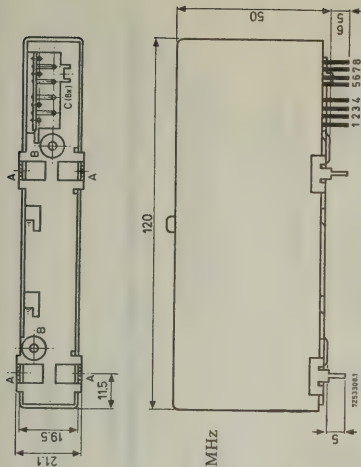
max. ± 5 ns

between +20°C and +50°C

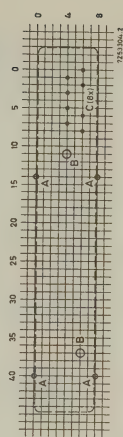
typical $\pm < 0.3$ dB

Maximum input at f_{nom} 10 V_{p-p}

Termination impedances 100 Ω



Connections: V_{in} to 4 and 3
 V_{out} to 5 and 6



A = Fastening pins
B = Fixing holes (M3)
C = Connecting pins (0.8 mm diam.)

Hole pattern for mounting on a printed-wiring board. $e = 2.54$ mm.

COMPONENTS FOR COLOUR TELEVISION

Delay lines DL 50, catalogue number 2722 121 00121

DL 51, catalogue number 2722 121 00131

For use in decoder circuits of colour television receivers up to European PAL standard (DL50) and to European PAL/SECAM standard (DL51) respectively.

Electrical data

Nominal frequency f_{nom} 4.433619 MHz

Phase delay-time ($V_{in} - V_{out}$) at f_{nom} (unmodulated sine-wave voltage)

63.943 \pm 0.005 μ s

better than from 3.43 to 5.23 MHz

8 \pm 3 dB

Insertion loss at f_{nom}

Drift of phase delay with temperature (relative to 25°C) max. 5 ns

Maximum input voltage at f_{nom} 15 V_{p-p}

Termination-

resistance

R_1, R_2 390 Ω

capacitance

C_1 120 pF

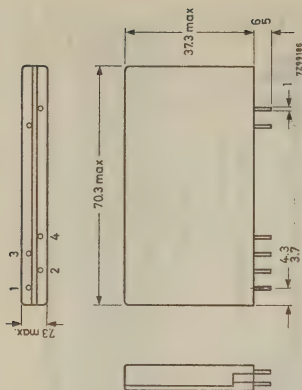
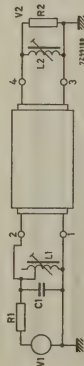
inductive reactance

L_1 128 Ω

L_2 231 Ω'

20 pF

Maximum capacitance of the coils



Connections: V_{in} to 2 and 1
 V_{out} to 4 and 3



Recommended hole pattern for mounting on a printed-wiring board.
 $e = 2.54$ mm.

For use in decoder circuits of colour television receivers up to Brazilian PAL standard.

Electrical data

Nominal frequency f_{nom}

Phase delay time at f_{nom} (unmodulated sine wave voltage)

Bandwidth

Insertion loss

Temperature drift of phase delay

Maximum input voltage at f_{nom}

Termination-

resistance

capacitance

inductive reactance

Maximum capacitance of the coils

3.575611 MHz

63.48 μ s

< 2.7 to > 4.4 MHz

8 \pm 3 dB

max. 5 ns, typ 3 ns

15 V_{p-p}

R_1, R_2 560 Ω

C_1 120 pF

L_1 337 Ω

L_2 405 Ω

20 pF

For circuit diagram and mechanical data see DL50,
DL51 page C288

COMPONENTS FOR COLOUR TELEVISION

Delay line DL 55

Catalogue number 2722 121 00171

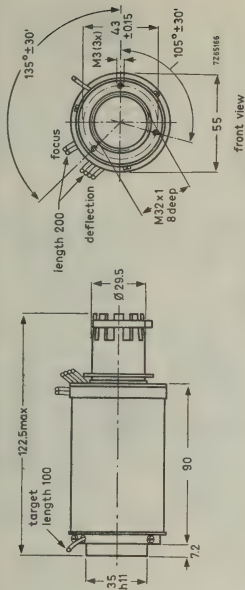
For use in decoder circuits of colour television receivers up to NTSC standard.

Electrical data

Nominal frequency f_{nom}	3.579545 MHz
Phase delay time at f_{nom} (unmodulated sinewave voltage)	63.55 μs
Bandwidth	< 2.7 to > 4.4 MHz
Insertion loss	8 ± 3 dB
Temperature drift of phase delay	5 ns, typ 3 ns
Maximum input voltage at f_{nom}	15 V_{p-p}
Termination-resistance	R_1, R_2 560 Ω
capacitance	C_1 120 pF
inductive reactance	L_1 337 Ω
	L_2 405 Ω
Maximum capacitance of the coils	20 pF

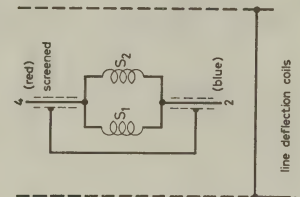
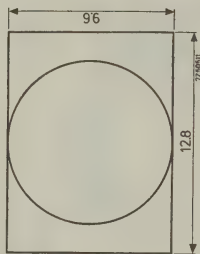
For circuit diagram and mechanical data see DL50,
DL51 page C288

Vidicon deflection unit AT 1102/01

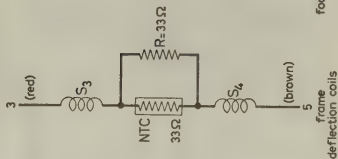


Catalogue number: 3122 137 10580

Distortions inside the circle: about 1 % of picture height
Distortions outside the circle: about 2 % of picture height



line deflection coils



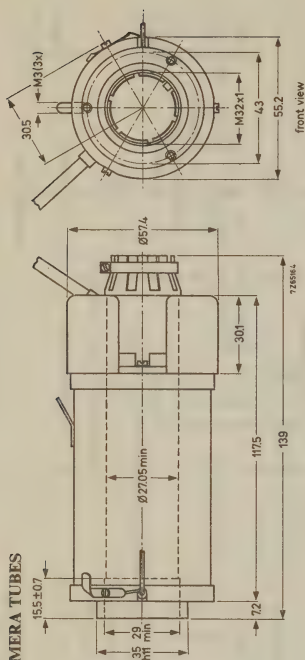
frame deflection coils



focus coil 7250509

DEFLECTION ASSEMBLIES FOR CAMERA TUBES

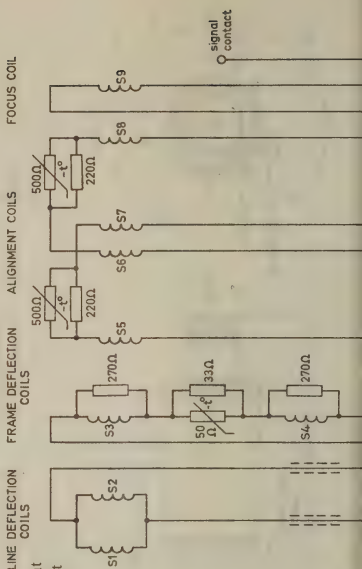
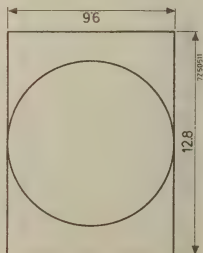
Plumbicon deflection unit AT 1103



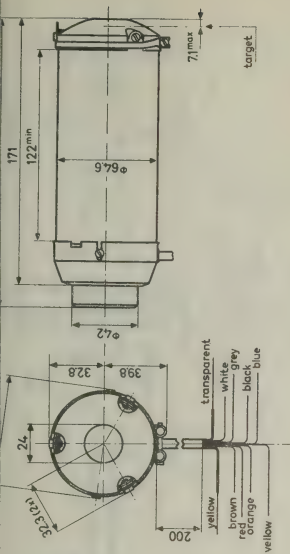
Catalogue number: 3122 107 13560

Distortions inside the circle: max. 0.5 % of picture height

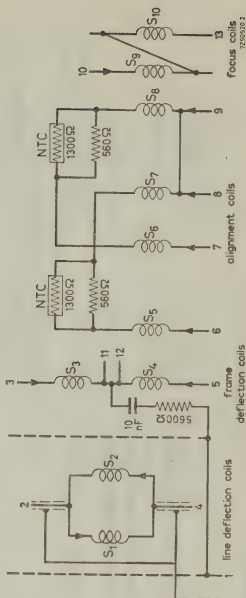
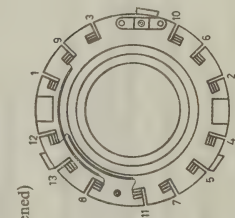
Distortions outside the circle: max. 1 % of picture height



Distortions inside the circle: max. 0.5% of picture height
Distortions outside the circle: max. 1% of picture height



- 1 = black
2 = transparent (screened)
3 = brown
4 = yellow (screened)
5 = red
6 = orange
7 = yellow
8 = 9 = blue
10 = white
11 = —
12 = —
13 = grey



DEFLECTION ASSEMBLIES FOR CAMERA TUBES

Plumbicon deflection units AT 1113/03

The AT 1113/03 is a selected triplet existing of three plumbicon deflection units AT 1113/01.

The deflection units are supplied in matched sets of three units wherein the misregistration in any set is not greater than 0.1 % of picture height inside the circle and 0.25 % outside the circle.

For further data see plumbicon deflection unit AT 1113/01.

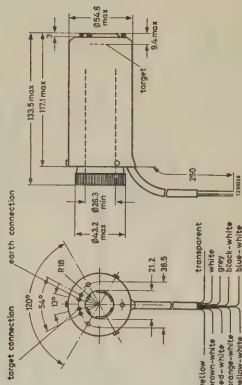
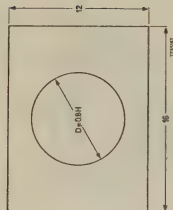
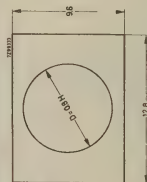
Plumbicon deflection units AT 1115

The AT 1115 is a computer selected triplet existing of three plumbicon deflection units.

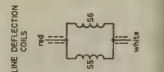
Catalogue number 3122 137 10020

Distortions inside the circle: max. 0.5 % of picture height

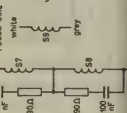
Distortions outside the circle: max. 1 % of picture height



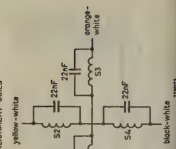
FRAME DEFLECTION COILS



FOCUS COIL

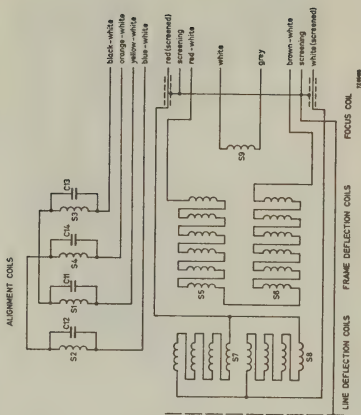
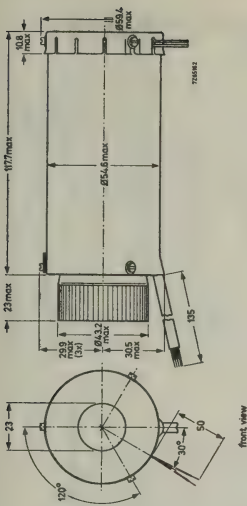
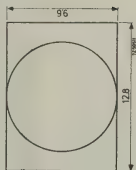


ALIGNMENT COILS



The deflection units are supplied in matched sets of three units wherein the misregistration in any set is not greater than 0.05 % of picture height inside the circle and 0.1 % outside the circle.

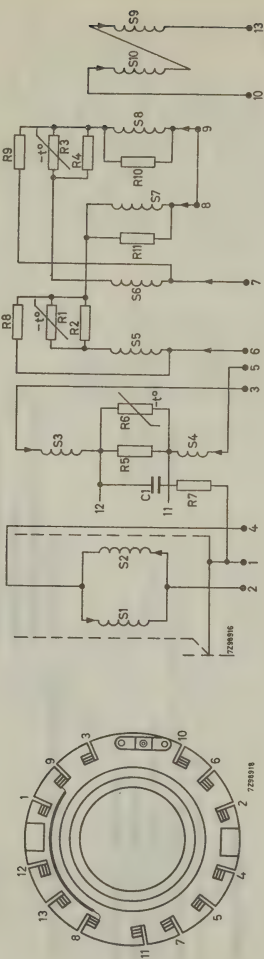
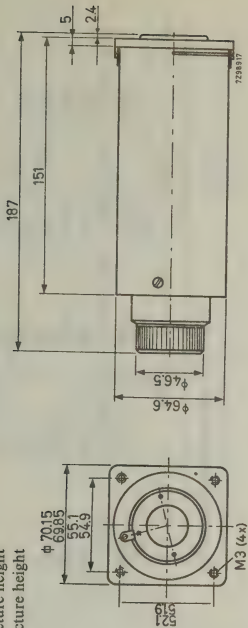
Catalogue number 3122 137 10971
Distortions inside the circle: max. 0.5% of picture height
Distortions outside the circle: max. 1% of picture height



Distortions inside the circle : max. 0.5% of picture height

Distortions outside the circle: max. 1% of picture height

- S_1-S_2 = line deflection coils
 S_3-S_4 = frame deflection coils
 S_5-S_8 = alignment coils
 S_9-S_{10} = focus coils



SYNCHRONOUS MOTORS

Unidirectional motors

- 9904 110 02 . . . : standard type
 9904 110 03 . . . : type for high ambient temperature
 9904 110 04 . . . : under voltage type
 9904 110 05 . . . : small type
 9904 110 06 . . . : silent type

When ordering or inquiring please indicate: - catalog number

- voltage and frequency of the supply
- direction of rotation
- version with or without pinion.

Catalog number 9904 110

	02 . . . (Fig. 1)	03 . . . (Fig. 2)	04 . . . (Fig. 1)	05 . . . (Fig. 3)	09 . . . (Fig. 4)
Voltage ¹⁾	220	220	220	220	220
Permissible voltage fluctuations	-15 to +10	-15 to +10	-30 to +10	-15 to +10	-15 to +10
Frequency	50	50	50	50	50
Speed	250	250	250	250	375
Starting torque	25	15	15	5	150
Working torque	30	15	15	5	150
Power consumption	1.6	2.2	1.7	1.8	4
Temperature increase	30	40	30	20	50
Ambient temperature range	-20 to +70	-20 to +120	-20 to +50	-20 to +70	-20 to +40

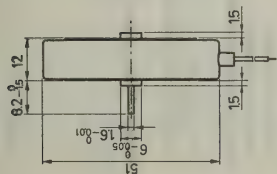


Fig. 1

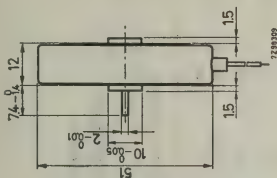


Fig. 2

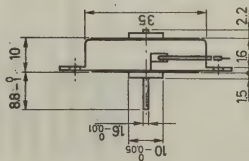
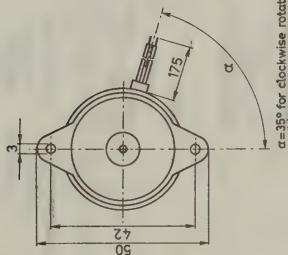


Fig. 3



$\alpha = 35^\circ$ for clockwise rotation
 $= 75^\circ$ for counterclockwise rotation

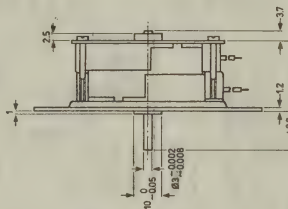
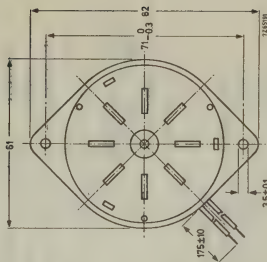


Fig. 4



1) Versions for other supply voltages (117, 110, 48, 24, 12 V) are available on request.

Reversible motors (to be used with phasing capacitor)

Catalog number 9904 111

04 ... (Fig. 1) (medium torque type)		05 ... (Fig. 2) (high torque type)		06 ... (Fig. 3) (high torque slender type)		07 ... (Fig. 4) (small type)	
coils in		coils in		coils in		coils in	
parallel (Fig. 5)	series (Fig. 6)	parallel (Fig. 7)	series (Fig. 8)	parallel (Fig. 5)	series (Fig. 6)	parallel (Fig. 5)	series (Fig. 6)
220	380	220	380	110	220	110	220
- 15 to + 10		- 15 to + 10		- 15 to + 10		- 15 to + 10	
50/60		50		50/60		50/60	
250/300		250		250/300		250/300	
100/150		325	400	300		25	
100/150		375	450	375		25	
1.8	3.5	3.3	3.7	5		0.5	1.3
25	50	40	45	35		10	25
- 20 to + 70	- 20 to + 50	- 20 to + 70	- 20 to + 40	- 20 to + 70		- 20 to + 70	

¹⁾ Versions for other supply voltages (117, 110, 48, 24, 12 V) are available on request.

When ordering or inquiring please indicate: - catalog number

- voltage and frequency of the supply

- version with or without pinion.

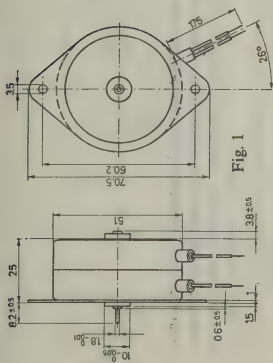


Fig. 1

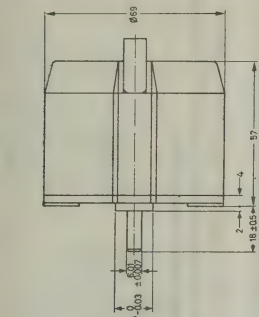


Fig. 2

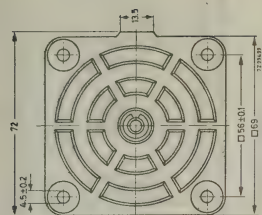


Fig. 3

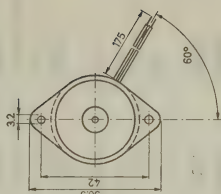
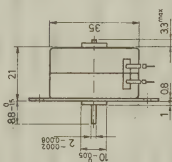
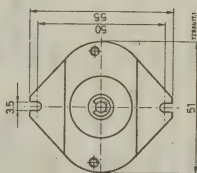
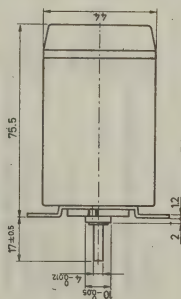


Fig. 4

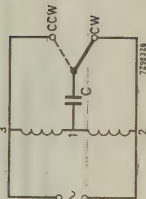
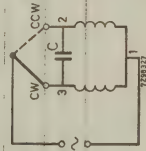
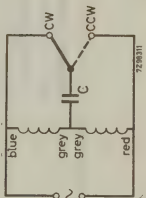
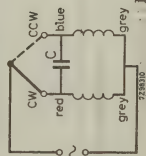


Fig. 5

Fig. 6

Fig. 7

Fig. 8

Catalogue number 9904 115.....

versions according to Fig. 1

versions according to Fig. 2

clockwise rotation	01061	02061	04061	03002 ¹⁾	05002	07002
counterclockwise rotation	01071	02071	04071	03012 ¹⁾	05012	07012
Voltage (V)	220	110	117	220	117	110
Permissible voltage fluctuations (%)	-15 to +10	-15 to +10	-15 to +10	-15 to +10	-15 to +10	-15 to +10
Frequency (Hz)	50	50	60	50	60	50
Speed (rev/min)	8	8	9.6	1	1.2	1
Power consumption (W)	2	2	2.5	2	2.5	2
Working torque ²⁾ (gcm)	400	400	380	1500 ³⁾	1500 ³⁾	1500 ³⁾
Temperature increase (deg C)	50	50	60	50	60	50
Permissible ambient temperature (°C)	-5 to +50	-5 to +50	-5 to +40	-5 to +50 ³⁾	-5 to +50 ³⁾	-5 to +50 ³⁾
Maximum radial force (g)	1000	1000	1000	1000 ³⁾	1000 ³⁾	1000 ³⁾

¹⁾ Available with a spindle diameter of 3 mm under catalogue numbers 9904 115 03001 (cw) and 9904 115 03011 (ccw).

²⁾ Torque at nominal voltage.

³⁾ It is allowed to use this synchrodriver intermittently in the temperature range +50 to +120°C (+50 to +100°C for the synchrodrivers 9904 115 05002 and 9904 115 05012). As a result the maximum permissible torque and the maximum radial force decrease; at 120°C the maximum permissible torque is 300 gcm, the maximum radial force is 100 g.

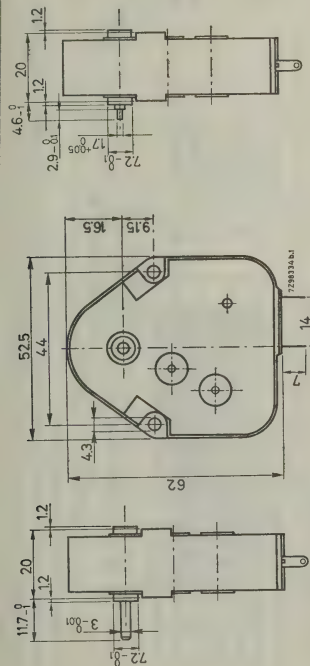


Fig. 1

Versions with a speed of 8 rev/min

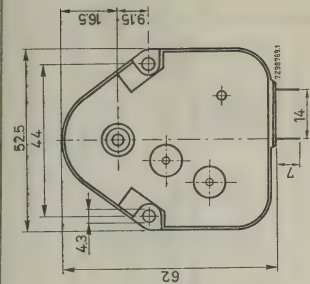


Fig. 2

Versions with a speed of 1 rev/min

UNIVERSAL PROGRAMME SWITCH ASSEMBLY KIT (UPAK)

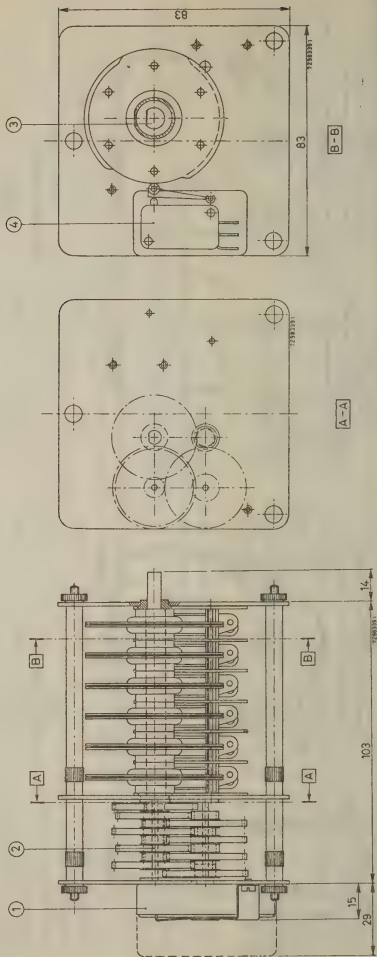
C304

This assembly kit is used to construct a programme switch from a limited number of components for many different timing cycles.

Two types of kits are available:

- for use with 50 Hz supply, catalog number 9904 131 02001
- for use with 60 Hz supply, catalog number 9904 131 02002.

The universal programme switch has four basic parts, which are indicated by a number, see the figure.



Each kit contains two motors (one unidirectional, the other reversible) chosen from the wide range available. The essential characteristics of two possible choices are listed below.

	catalog number of kit	
	9904 131 02001	9904 131 02002
Catalog number of motor	9904 110 02124	9904 111 04134
Type of motor	unidirectional	reversible
Supply voltage required (V)	220	220
Supply frequency required (Hz)	50	50
Speed of rotation (rev/min)	250	250
Working torque (gcm)	30	100
		9904 110 02223
		unidirectional
		117
		60
		300
		100
		9904 111 04332
		reversible
		117
		60
		300
		100

A large number of gear ratios can be obtained from the selection of pinions and gear-wheels provided, giving spindle speeds of between 1 rev/min and 1 rev/24 h.

The camshaft carries up to six adjustable cams, each cam comprising two separate discs which can be mutually adjusted (by means of a special tool on which the angle of adjustment is indicated) in order to obtain the required switching time.

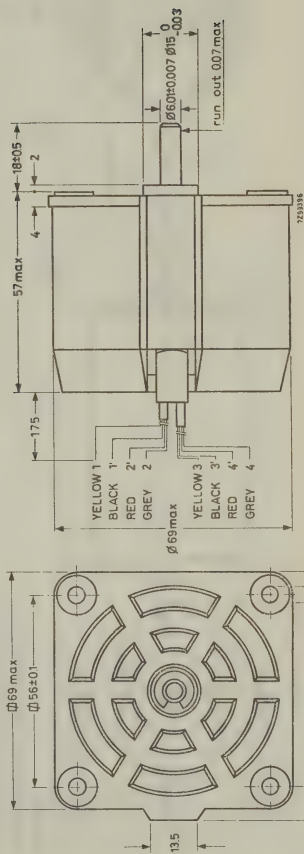
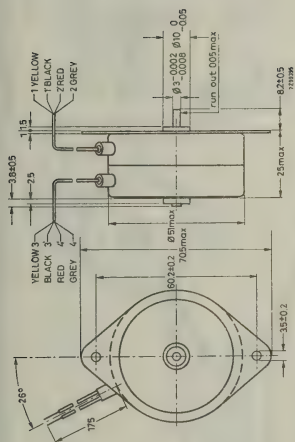
Consisting of six microswitches with alternating contacts, insulator plates, operating levers and rollers.

STEPPER MOTORS¹⁾

The data given below for the different motors were obtained using the electronic switch cat. no. 9904 131 03003 for the four-phase motors, and the switch cat. no. 9904 131 03004 for the eight-phase motor. It is recommended that these units be used with the motors, as motor performance is then assured. The switches are very compact, highly reliable, and inexpensive, the logic section employing integrated circuits and the output stages power transistors. The board supply voltage is $5\text{ V} \pm 5\%$.

Industrial Digital (ID) motors, catalog number 9904 112.....

	ID 04 (Fig. 1)	ID 05 (Fig. 2)	ID 06 (Fig. 3)	ID 07 (Fig. 4)	ID 08 (Fig. 2)
Maximum torque (gcm)	150	650	500	60	350
Holding torque (gcm)	225	900	700	80	650
Maximum pull-in rate (steps/s)	350	240	200	500	160
Maximum pull-out rate (steps/s)	550	360	320	1000	450
Number of steps per revolution	48	48	48	48	24
Step angle	7°30'	7°30'	7°30'	7°30'	15°
Power consumption (W)	3.3	5.5	4	1.7	5.5
Permissible ambient temperature (°C)	-20 to +70	-20 to +70	-20 to +70	-20 to +70	-20 to +70
Permissible storage temperature (°C)	-40 to +85	-40 to +100	-40 to +100	-40 to +100	-40 to +100
Permissible motor temperature (°C)	100	100	100	100	100
Bearings	sleeve	needle	sleeve	sleeve	needle
Rotor inertia (gcm ²)	11	93	90	2.6	93
Catalog number	9904 112 04101	9904 112 05101	9904 112 06101	9904 112 07101	9904 112 08101



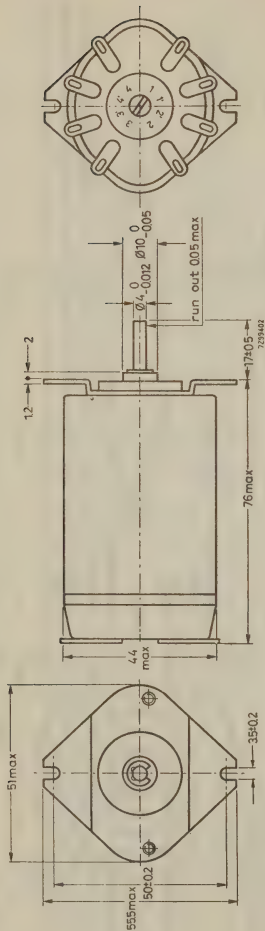


Fig. 3

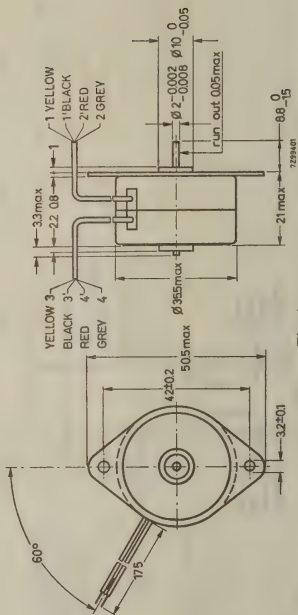


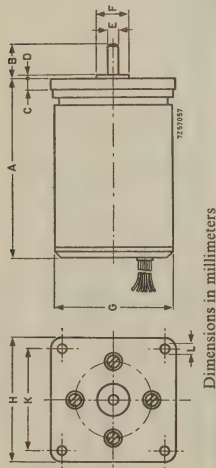
Fig. 4

(4 phases)

	type number, followed by suffix of catalog number between brackets					
	PD 10 (10001)	PD 14 (14001)	PD 18 (18001)	PD 22 (22001)		
	SMD 11 (11001)	SMD 15 (15001)	SMD 19 (19001)	SMD 23 (23001)		
Maximum torque (gcm)	70	250	1000	600		
Holding torque (gcm)	100	350	1400	800		
Maximum pull-in rate (steps/s)	500	360	260	140		
Maximum pull-out rate (steps/s)	100	550	340	460		
Number of steps per revolution	48	48	48	24		
Step angle	7° 30'	7° 30'	7° 30'	15°		
Power consumption (W)	1.75	3.7	6.5	6.5		
Permissible ambient temperature (°C)	- 54 to + 85	- 54 to + 85	- 54 to + 85	- 54 to + 85		
Permissible storage temperature (°C)	- 62 to + 110	- 62 to + 110	- 62 to + 110	- 62 to + 110		
Permissible motor temperature (°C)	125	125	125	125		
Bearings	ball	ball	ball	ball		
Rotor inertia (gcm ²)	3.5	18	110	110		

STEPPER MOTORS

Professional digital motors

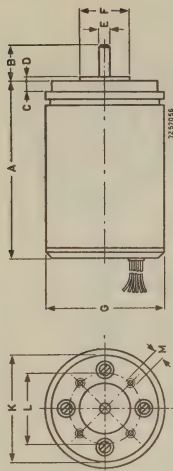


Dimensions in millimeters

Fig. 5

Type number	PD 10	PD 14	PD 18	PD 22
A	46	55.5	75	
B	12	15	20	
C	4	5	6	
D	1.5	2	2	
E	4h6	5h6	7h6	
F	15	15	20	
G	38	57	70.5	
H	38.2	58.5	72.5	
K	31	47	60	
L	3.6	4.6	5.5	
Lead length	175	175	175	

Servo mount digital motors



Dimensions in inches

Fig. 6

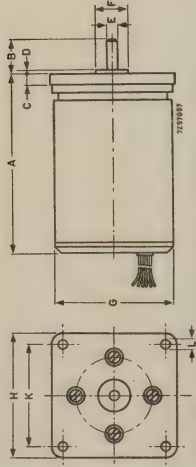
Type number	SMD 11	SMD 15	SMD 19	SMD 23
A	1.775	2.185	2.980	
B	0.470	0.590	0.785	
C	0.132	0.200	0.185	
D	0.040	0.063	0.063	
E	0.15625	0.1875	0.2501	
F	0.8750	0.9375	0.9375	
G/H	1.50	2.25	2.76	
K	1.312	2.000	2.500	
L	1.10	1.578	1.578	
M	4-40 UNC	4-40 UNC	4-40 UNC	
Lead length	6.9	6.9	6.9	

(8 phases)

	type number, followed by suffix of catalog number between brackets					
	PD 12 (12001) SMD 13 (13001)	PD 16 (16001) SMD 17 (17001)	PD 20 (20001) SMD 21 (21001)	PD 24 (24001) SMD 25 (25001)		
Maximum torque (gcm)	150	400	1600	900		
Holding torque (gcm)	180	500	1900	1100		
Maximum pull-in rate (steps/s)	1200	900	650	350		
Maximum pull-out rate (steps/s)	16000	7500	6000	3500		
Number of steps per revolution	96	96	96	48		
Step angle	3°45'	3°45'	3°45'	7°30'		
Power consumption (W)	3.5	6.5	11	11		
Permissible ambient temperature (°C)	-54 to +85	-54 to +85	-54 to +85	-54 to +85		
Permissible storage temperature (°C)	-62 to +110	-62 to +110	-62 to +110	-62 to +110		
Permissible motor temperature (°C)	125	125	125	125		
Bearings	ball	ball	ball	ball		
Rotor inertia (gcm ²)	7	32	220	220		

STEPPER MOTORS

Professional digital motors

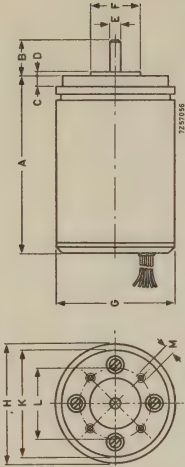


Dimensions in millimeters

Fig. 7

Type number	PD 12	PD 16	PD 20	PD 24
A	64	78.5	108	
B	12	15	20	
C	4	5	6	
D	1.5	2	2	
E	4h6	5h6	7h6	
F	15	15	20	
G	38	57	70.5	
H	38.2	58.5	72.5	
K	31	47	60	
L	3.6	4.6	5.5	
Lead length	175	175	175	

Servo mount digital motors



Dimensions in inches

Fig. 8

Type number	SMD 13	SMD 17	SMD 21	SMD 25
A	2.480	3.090	4.270	
B	0.470	0.590	0.785	
C	0.132	0.200	0.185	
D	0.040	0.065	0.063	
E	0.15625	0.1875	0.250	
F	0.8750	0.9375	0.9375	
G/H	1.50	2.25	2.76	
K	1.312	2.000	2.500	
L	1.100	1.578	1.578	
M	4-40 UNC	4-40 UNC	4-40 UNC	
Lead length	6.9	6.9	6.9	

DIRECT CURRENT MOTORS

Governed d.c. motors

catalog number 9904 120,			
	01501 ¹⁾ (Fig. 1)	03101 (Fig. 2)	53101 ²⁾ (Fig. 3)
Nominal voltage (V _{d.c.})	4.5	3.2	3
Nominal torque (gcm)	≥ 11	≥ 18	150
Speed at nominal load (rev/min)	2000	2000	96
at no load (rev/min)	2650	3500	110
Current at nominal load (A)	0.110	0.265	≤ 0.15
at no load (A)	0.035	0.05	≤ 0.05
Input power (W)	≤ 0.6	≤ 0.85	≤ 0.45
Permissible ambient temperature (°C)	-10 to +50	-10 to +50	-10 to +50

¹⁾ A version of this motor with interference-suppression filter is available under catalog number 9904 120 01502.

²⁾ 4 different gear ratios available giving: - speeds from 96 to 1600 rev/min

- torques between 11 and 150 gcm

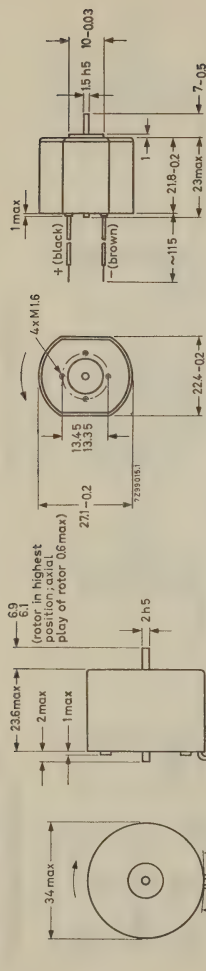


Fig. 1

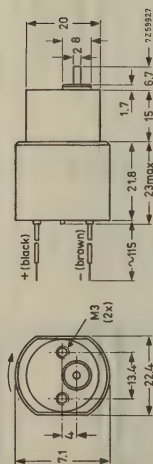


Fig. 3

Fig. 2

or 9904 120 01502

Voltage range

Torque at 5 $V_{d.c.}$

Speed at nominal load

Current at no load

Starting torque at 5 $V_{d.c.}$

at 9 $V_{d.c.}$

Speed control range for variations of:

supply voltage between 5 and 9 $V_{d.c.}$ and

load between 3 and 6 gcm and temper-

ature between 0 and 45°C

Ambient temperature range

: 5 to 9 $V_{d.c.}$

: ≥ 6 gcm

: 2000 rev/min

: ≤ 35 mA (motor) + 8 mA (control unit)

: ≥ 30 gcm

: ≥ 60 gcm

: 2000 rev/min + or - 3%

: - 10 to + 50°C

Ungoverned d.c. motors

catalog number 9904 120

51401¹⁾ (Fig. 1) 51601¹⁾ (Fig. 1) 07401 (Fig. 2) 07601 (Fig. 2) 54301 (Fig. 4) 06601 (Fig. 5)
08401 (Fig. 3) 08601 (Fig. 3)

Nominal voltage ($V_{d.c.}$)	6	12	6	12	4.5	12	
Nominal torque (gcm)	100	100	30	30	200	50	
Speed at nominal load (rev/min)	690	690	3900	3900	225	5900	
at no load (rev/min)	845	845	4900	4900	280	7000	
Current at nominal load (A)	0.340	0.170	0.375	0.190	0.36	0.4	
at no load (A)	0.100	0.055	0.095	0.055	0.135	0.1	
Input power (W)	2.1	2.1	2	2	1.7	4.8	
Permissible ambient temperature (°C)	- 20 to + 60	- 20 to + 60	- 20 to + 60	- 20 to + 60	- 10 to + 50	- 20 to + 60	

¹⁾ 10 different gear ratios available giving: - speeds from 6 to 690 rev/min
- torques between 100 and 1500 gcm

DIRECT CURRENT MOTORS

C316

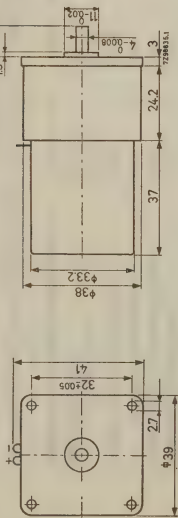


Fig. 1

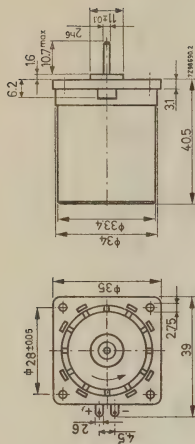


Fig. 2

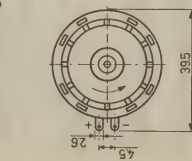


Fig. 3

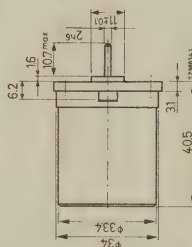
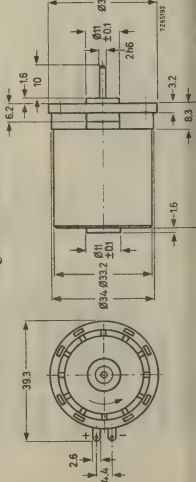
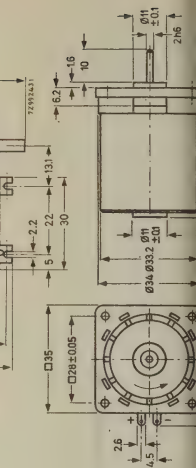


Fig. 4



Servomotor with a.c. tachogenerator, catalogue number 9904 121 00011

Nominal voltage¹⁾ : 110/220 V_{a.c.} motor reference coil;
9/18 V motor control coil

Frequency : 50 Hz

Starting torque at 150 rev/min : ≥ 135 gcm

Maximum torque : ≥ 135 gcm

Speed at maximum torque : 150 rev/min

at no load : ≥ 2400 rev/min

at maximum output : 1400 rev/min

Maximum output power : ≥ 1.2 W

Input power at no load : ≤ 3 W motor reference coil;

≤ 3 W motor control coil

: ≤ 35 mA motor reference coil;

≤ 375 mA motor control coil

: reversible

: I.E.C. 65, class E

: 50 V, 50 Hz

Insulation according to Voltage, generator reference coil

Voltage, generator outgoing coil,

at 2400 rev/min : ≥ 250 mV

at 0 rev/min : ≤ 1.5 mV

Reference coils of motor

between 4 and 7: 220 V, 50 Hz and 5 and 6 interconnected;

between 4 and 6: 110 V, 50 Hz, 6 and 7

interconnected and 4 and 5 interconnected.

between 1 and 3: 18 V, 50 Hz;

between 1 and 2: 9 V, 50 Hz and

between 2 and 3: 9 V, 50 Hz

between 7 and 8: 50 V, 50 Hz.

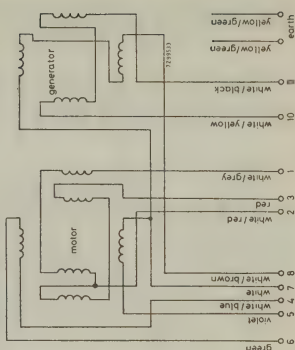
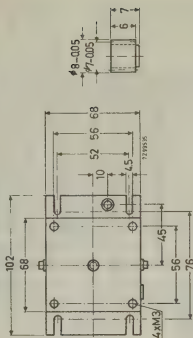
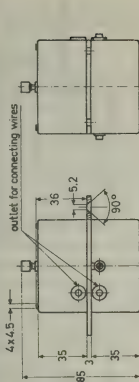
between 9 and 10.

Control coils of motor

Reference coils of generator

Outgoing coils of generator

¹⁾ Versions for other supply voltages are available on request.



TACHO GENERATORS AND SERVOMOTORS

D.c. Tachogenerators, catalogue number 9904 121 000 . .

Type	spigot-flange				base-mounting		
Spindle diameter	(mm)	7	10	11	7	10	11
Catalogue number 9904 121 000 . .		32 ¹⁾	41 ¹⁾	31 ²⁾	34 ²⁾	53 ¹⁾	52 ¹⁾
Output voltage	(V/rev/min)	0.06	0.10	0.06	0.06	0.10	0.06
Max. permissible speed	(rev/min)	10000	6000	10000	10000	6000	10000
Max. permissible output current	(A)	0.25	0.16	0.25	0.25	0.16	0.25
Armature resistance at 20°C	(Ω) ± 3 %	59	165	59	59	165	59

Max. output voltage at no-load 600 V

Direction of rotation reversible

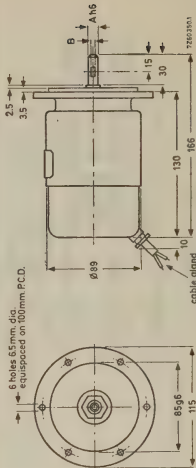
Voltage temperature coefficient 0.01 %/deg C

Ambient temperature range operational -15 to +65°C

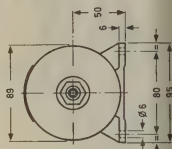
storage -30 to +85°C

Insulation according to IEC65 class E

Rotor inertia 8450 gcm²



Spigot-flange type



¹⁾ Cable, shielded, 1 metre long, wire size 2 × 0.6 mm² (flying leads)

²⁾ Cable, shielded, 1 metre long, wire size 2 × 0.6 mm² (with cable gland)

MANGANESE ZINC AND NICKEL ZINC FERRITES

Introduction

The predominant feature of ferroxcube lies in its high resistivity that allows cores to be made of solid material without the eddy current losses becoming prohibitively high, even if the cores are used in the megacycle range. Compared with the powder-iron, the permeability of ferroxcube is high, whereas the losses remain comparatively low.

Ferroxcube cores are available in convenient shapes such as potcores, square cores*, E- and I-cores, X-cores, toroids, U-cores, aerial rods, yoke rings, screw cores, rods and tubes.

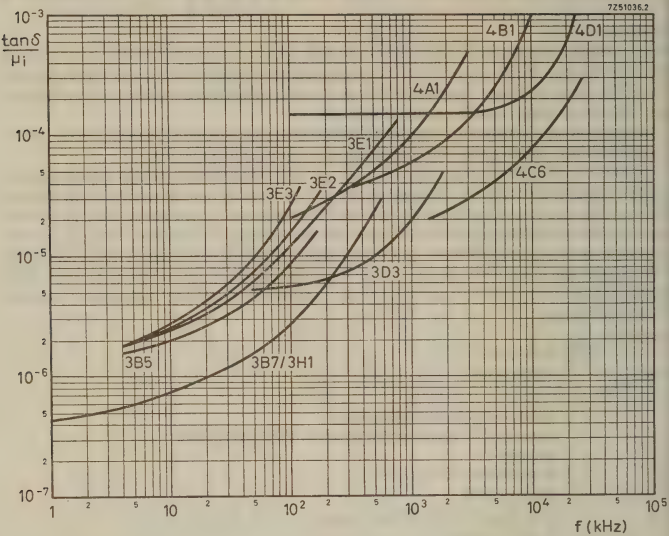
Potcores, E-I cores and X cores enable well-defined air gaps to be used without introducing appreciable stray fields. In this way the permeability of the material may be reduced to an effective value at which core and copper losses are matched. The dependence of the permeability on temperature and time is furthermore reduced to values that guarantee correct operation of the equipment. This section contains comprehensive data on manganese zinc ferrites (ferroxcube 3) and nickel zinc ferrites (ferroxcube 4) and their various grades. The latter material in general shows higher specific resistance values, lower values of permeability and saturation flux density, higher coercivities and higher Curie points.

Application

<i>grade</i>	<i>application</i>
3B	potcores, cores for small coils
3B3	frames for i.f. transformers, potcores, rods, screw cores
3B5	potcores
3B7	potcores and square cores
3C1	erasing heads
3C2	yoke rings, L-cores, erasing heads
3C6	E- and U-cores
3C8	U- and I-cores, E-cores
3D3	potcores, square cores, screw cores
3E1	E- and I-cores, toroids, potcores
3E2	H-cores and toroids
3E3	toroids
3H1	potcores, square cores, small toroids, cross cores, erasing heads
4A3	aerial rods
4A4	frames for i.f. transformers
4B1	aerial rods, frames for i.f. transformers
4C1	rods and tubes
4C6	potcores, square cores, toroids, frames for i.f. transformers
4D1, 4D2, 4E1	frames for i.f. transformers, screw cores, tubes and rods
4H1	These are special-purpose NiZn ferrites developed for one type of application, namely resonant cavities for particle accelerators. In this field, usually a technical discussion is necessary before the correct material can be determined.
4L ₁	
4L ₂	
4MX	

*) Square cores actually are square potcores.

MANGANESE ZINC AND NICKEL ZINC FERRITES



Eddy current losses and residual losses as a function of the frequency at low induction level

FERRITES FOR RADIO, AUDIO AND TELEVISION

Antenna rods and plates

Standard types

Rods

Grade 4A3

<i>dimensions (mm)</i>	<i>catalog number</i>
Ø 10 × 240	3122 104 93440
× 230	4311 020 53120
× 220	4311 020 52740
× 210	3122 104 93700
× 200	3122 104 93420
× 190	4311 020 53230
× 180	3122 104 93450
× 170	4311 020 52760
× 160	4311 020 52610
× 150	4311 020 52770
× 140	3122 104 93460
× 130	4311 020 52780
× 120	4311 020 53300
× 100	4311 020 52590
Ø 7.8 × 190	4311 020 52700
× 140	4311 020 52690
× 130	4311 020 52680
× 100	4311 020 52790
Ø 6.35 × 130	4311 020 52800
× 100	4311 020 52810

Grade 4B1

<i>dimensions (mm)</i>	<i>catalog number</i>
Ø 10 × 204	3122 104 91250
× 175	4311 020 52240
× 140	3122 104 91240
× 130	4311 020 52230
Ø 9.8 × 200	4311 020 50040
× 160	4311 020 50250
× 100	4311 020 52170
Ø 6.5 × 165	4311 020 52160

FERRITES FOR RADIO, AUDIO AND TELEVISION

Plates

Grade 4B1	dimensions (mm)	catalog number
	19 × 3.8 × 150	4311 020 52410
	× 125	4311 020 52400
	× 100	4311 020 52390
	× 75	4311 020 52380
	13.4 × 4.15 × 120	3122 104 92140
	× 94	3122 104 92120
	× 62	3122 104 92150

Cores for small coils, e.g. i.f. transformers

Preferred types

To be used as cores in r.f. and h.f. coils with an open magnetic circuit such as in i.f. transformers.

Rods

dia. (mm)	length (mm)	grade	catalogue number
1.4	6.75	3D3	3122 104 91920
		4C5	3122 104 92040
		4D1	3122 104 91910
1.5	6.75	3D3	4322 020 39390
1.5	18.2	3B	3122 104 93320
1.65	9.2	3D3	4312 020 30160
		4B1	3122 104 91060
		3B1	3122 104 91070
	11.5	3B1	4322 020 32100
	12.2	3B1	3122 104 91100
		4B1	3122 104 91110
		3D3	4312 020 30170
	19.2	3B	3122 104 91230
	25.2	3B	3122 104 91170
		4B1	3122 104 91180
		4C1	3122 104 91160
	28.2	4B1	4322 020 32090
		3B	3122 104 91090

<i>dia. (mm)</i>	<i>length (mm)</i>	<i>grade</i>	<i>catalog number</i>
.7	7.5	4E1	4322 020 39300
	8.4	4D1	3122 104 93160
		3B	3122 104 90300
	10.2	4D1	4322 020 32040
	14.2	4E1	4322 020 32060
	15.2	4D1	4322 020 32170
	17.8	3B	3122 104 92020
	18.7	3B	3122 104 91900
	28.2	4C1	4322 020 32120
		4D1	4322 020 32130
1.75		4E1	4322 020 32140
	10.2	3B	3122 104 91130
	12.2	4B1	3122 104 92070
	12.7	3B	3122 104 91970
	17.5	3B	3122 104 91210
		4B1	4322 020 32050
	18.5	3B	3122 104 91140
		4B1	3122 104 91150
	18.7	3B	3122 104 91260
	25	3B	3122 104 91950
2.3	10.5	3D3	4312 020 30030
	12.5	3D3	4312 020 30180
	18.5	3D3	4312 020 30200
	17.3	3C6	4312 020 30420
3.45			
3.5	23.2	3C3	3122 104 92080
4.3	21.2	3C1	3122 104 91330
4.5	7.2	3D3	4322 020 39350
4.95	36	3C6	3122 104 90490
	16	3C6	4322 020 39340
	45	3C6	3122 134 90190
	50	3C6	3122 134 90110
5.55	40.1	3V6	4322 020 32240
	46.2	3C1	3122 104 91310
6	35.15	3C6	4322 020 39330
6.65	40.4	3B	4322 020 32160

FERRITES FOR RADIO, AUDIO AND TELEVISION

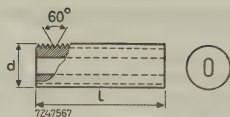
Tubes

<i>outer dia. (mm)</i>	<i>inner dia. (mm)</i>	<i>length (mm)</i>	<i>grade</i>	<i>catalogue number</i>
2.8	1.2+0.2	8.2	3B	4322 020 34340
3.6	1.3+0.2	4.2	3D3	4322 020 38340
			4C6	4322 020 38350
3.7	1.2+0.2	3.5	3B	4322 020 34400
			4A1	4322 020 34410
			4B1	4322 020 34420
		6.5	3B	4022 101 80010
3.7	1.7+0.2	13.7	4E1	4322 020 34330
4	1.8+0.4	23.2	3B	3122 104 90880
4.1	2+0.2	4.7	4C6	4322 020 38310
		7	3H1	4322 020 38330
4.15	2+0.2	7.2	4A1	4322 020 34440
		12.2	4A1	3122 104 90820
			4B1	4322 020 34450
			4C1	4322 020 34460
			4D1	4322 020 34470
			4E1	4322 020 36990
		15.2	4B1	4322 020 34380
			4C1	4322 020 34370
			4D1	4322 020 34360
4.3	2+0.2	7.2	3B	3122 104 92900
		11.5	3B	3122 104 94880
		15.4	3B	4322 020 36750
		16.5	3B	3122 104 94920
		18.5	3B	4322 020 36770
		21.2	4B1	3122 134 90160
		25.5	3B	4322 020 36780
			4B1	3122 104 90810
			4C1	3522 200 10950
			4D1	3522 200 10960
			4E1	3522 200 10970
		36.2	3B	3522 100 65950
		40.5	3B	3122 104 90800
		55.5	3B	4322 020 36800
		7.2	4D1	3122 104 93890
4.95	1.3+0.2	15.2	3C3	3122 104 90370
		23.2	3C3	3122 104 90380
	2.9+0.2	36	3C6	3122 104 93760
	1.3+0.2	36.2	3C3	3122 104 94030
		40.5	3C3	3122 104 93110
5.1	1.8+0.2	4.8	4D2	3122 104 94990
5.4	3.3+0.3	25.3	4A1	3122 104 93720
6.7	2.85+0.3	33.5	3B	4322 020 34300

Screw cores

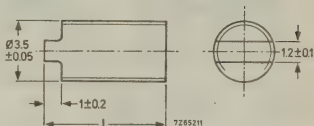
FXC grade 3D3

$\mu_i = 750 \pm 20\%$



screw thread	l (mm)	d (mm)	catalog number
M4 \times 0.50	12	3.65 ± 0.05	4312 020 32040
M5 \times 0.75	12	4.55 ± 0.05	4312 020 32050
M6 \times 0.75	25	5.55 ± 0.05	4312 020 32070
M6 \times 0.75	13	5.55 ± 0.05	4312 020 32060
M8 \times 1.25	25	7.35 ± 0.05	4312 020 32120
M8 \times 1.25	16	7.35 ± 0.05	4312 020 32110

Grade 3B



special cores for I.F. coils

	grade	l (mm)	pitch	catalogue number
5 \times 0.7	3B	10 ± 0.2	0.7	3122 104 90550
	4D1	10 ± 0.2	0.7	90590
	4B1	10 ± 0.2	0.7	93020
	4D1	7 ± 0.2	0.7	90740

FERRITES FOR RADIO, AUDIO AND TELEVISION

Beads for screening and damping, and wide-band h.f. chokes

APPLICATION

They are used in v.h.f. radio and TV receivers and in electric motors, ignition systems etc. to reduce in- or outgoing interference, and also in v.h.f. circuits to avoid troublesome coupling.

Beads (without wire)



Fig. 1

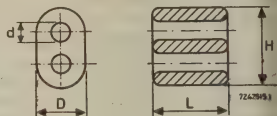


Fig. 2

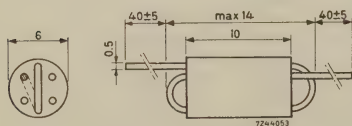


Fig. 3

Fig.	grade	L (mm)	D (mm)	H (mm)	d (mm)	catalog number
1	3B	3	3.5	—	1.3 ± 0.2	4322 020 34400
1	4B1	3	3.5	—	1.3 ± 0.2	4322 020 34420
1	3B	5	3.5	—	1.3 ± 0.2	4312 020 31060
2	4B1	8	8.5	14	$3.5 + 0.5$	4312 020 31570
2	4B1	14	8.5	14	$3.5 + 0.5$	4312 020 31520
3	3B	10	6	—	$0.7 + 0.2$	4312 020 31500
3	4B1	10	6	—	$0.7 + 0.2$	4312 020 31550

H.F. chokes

Dimensions in mm

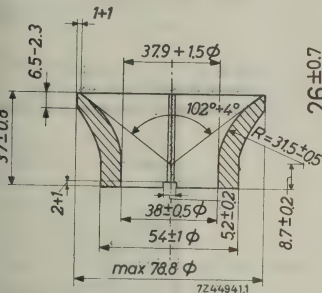


number of turns	Z_{opt} (k Ω)	f at Z_{opt} (MHz)	decrease of impedance in the freq. range (MHz)	dB	FXC grade	catalog number
1.5	0.25	120	10-300	≤ 7	3B	4312 020 36630
1.5	0.35	250	80-300	≤ 3	4B1	4312 020 36690
2.5	0.60	50	10-220, 30-100	$\leq 7, \leq 3$	3B	4312 020 36640
2.5	0.65	180	50-300, 80-220	$\leq 6, \leq 3$	4B1	4312 020 36700
2 \times 1.5	0.70	50	10-220, 30-100	$\leq 7, \leq 3$	3B	4312 020 36650
2 \times 1.5	0.80	110	50-300, 80-220	$\leq 7, \leq 3$	4B1	4312 020 36710

Yoke-rings for use in deflection coils for picture tubes

For 110° black and white picture tubes

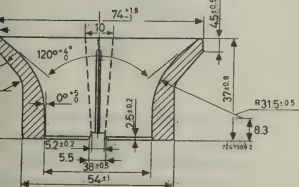
Dimensions in mm



Material : Ferroxcube 3C2

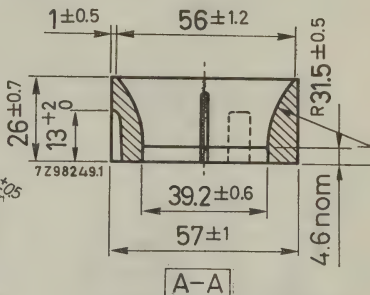
Catalog number: 3122 104 92180

(standard type)



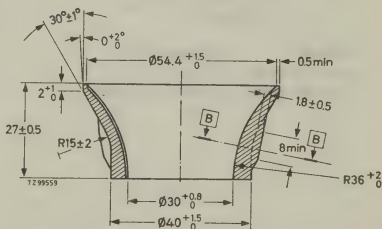
Material : Ferroxcube 3C2

Catalog number: 4322 020 35070



Material : Ferroxcube 3C2

Catalog number: 3122 104 93840

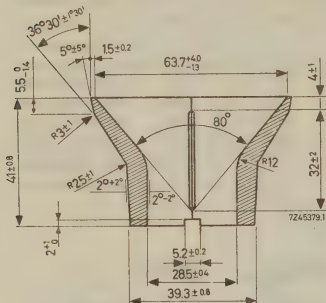


Material : Ferroxcube 3C2

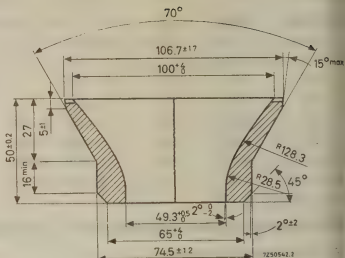
Catalog number: 3122 104 94790

FERRITES FOR RADIO, AUDIO AND TELEVISION

For tinyvision picture tubes (90°, 11 inch)

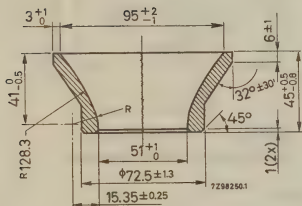


Material : Ferroxcube 3C2
Catalog number: 3122 104 90519

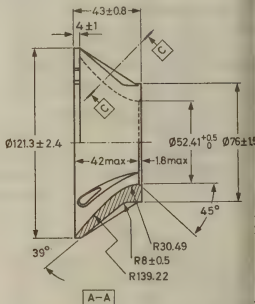


For 90° colour picture tubes

Material : Ferroxcube 3C2
Catalog number: 3122 108 12160
The inner surface has been lacquered.



Material : Ferroxcube 3C2
Catalog number: 3122 104 99170
The inner surface has been lacquered.



For 110° colour picture tubes.
Material : Ferroxcube 3C2
Catalog number: 3122 107 52200
The inner surface has been lacquered.

Cores for line-output transformers

Survey of U and I cores

type designation ¹⁾	legs cross-section	catalogue number	
		grade 3C6	grade 3C8
59/72/17	round		4312 020 33400
57/57/16	round	4312 020 33300	4312 020 33190
64/59/14	round	4312 020 33320	
70/62/17	round	3122 104 93570	
70/64/16	round	4312 020 33330	
70/67/17	round	4312 020 33040	3122 104 93950
146/43/11	round	3122 104 90480	
	round	3122 104 90470	
157/57/16	round	4312 020 33380	4312 020 33260
	round	4312 020 33390	4312 020 33270
158/58/16	octagonal	4312 020 33340	3122 104 94760
	octagonal	4312 020 33360	3122 104 94770
182/80/18	round	3122 104 93120	3122 104 93920
	round	3122 104 93130	3122 104 93910
60/54/11	round		4312 020 10210
80/89/16 ²⁾	round		4312 020 10230
83/86/14	octagonal		4312 020 10250
21/32/7	square		3122 134 90200
100/114/25	square	4312 020 33120	

The type designation gives the approximate overall dimensions and thickness of a magnetic circuit formed by 2 U's or one U and one I

U.S.A. types

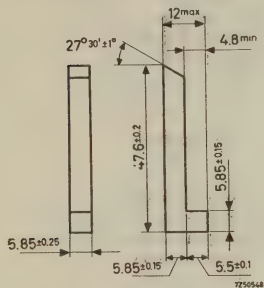
FERRITES FOR RADIO, AUDIO AND TELEVISION

Ferrites for colour tv components

For yoke rings and U-cores see previous pages

Special ferrite parts are:

Ferroxcube cores and ferroxdure magnets for convergence units



L-core

Ferroxcube 3C6

Catalog number: 3122 104 90680

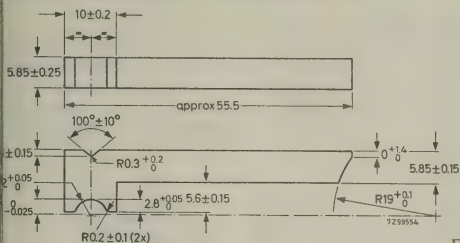


Disc magnet, diametrically magnetized

Ferroxdure 100

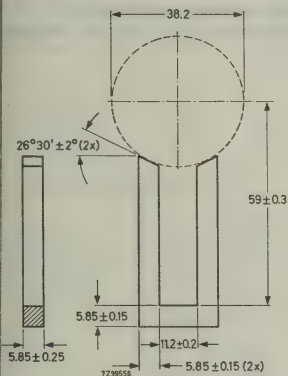
Catalog number: 3122 104 90620

Ferroxdure magnet for lateral convergency

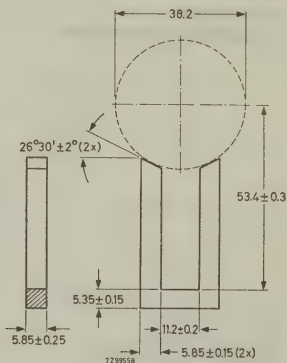


Ferroxdure 100 Magnet
Catalog number : 3122 104 94330

L-core
Ferroxcube 3C2
Catalog number : 3122 104 94090
3122 104 94601



U-core
Ferroxcube 3C2
Catalog number : 3122 104 94490



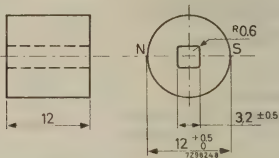
U-core
Ferroxcube 3C2
Catalog number : 3122 104 93780

FERRITES FOR RADIO, AUDIO AND TELEVISION

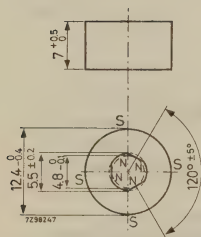
Ferroxcube rod and ferrite magnets for linearity-control units



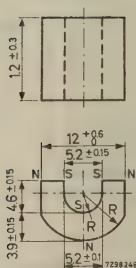
Rod core
Ferroxcube 3C6
Catalog number: 3122 104 90490



Ring magnet, diametrically magnetized
Ferroxdure 100. Catalog number 3122 104 92690



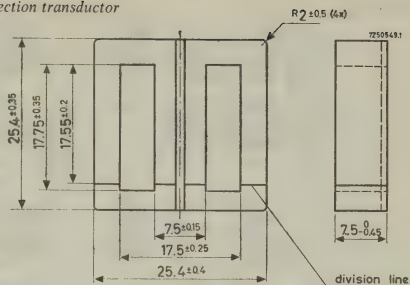
Ring magnet, radially magnetized
Plastic bonded ferroxdure P40
Catalog number: 3122 104 93530



Magnet segment, radially magnetized
Plastic bonded ferroxdure P40
Catalog number: 3122 104 93770

Ferroxcube E+I core for a raster correction transductor

E+I core
 Ferroxcube 3C6
 $\mu_e = 5.75 \text{ cm}$
 $\mu_e = 0.55 \text{ cm}^2$
 Catalog number: 3122 104 93210



Powder iron cores for small i.f. coils

Material properties

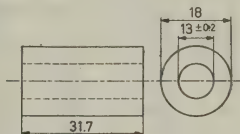
Main properties of the various grades of powder iron: 1P1, 1P2, 1P3.

freq. range	grade	Q-factor measured on a small ring	μ_i	particle size
up to 10 MHz	1P1	300 at 10 MHz	10 appr.	6-8 μm
up to 40-80 MHz	1P2	350 at 30 MHz	8.5 appr.	4-6 μm
up to 40-80 MHz	1P3 ¹⁾	350 at 30 MHz	8.5 appr.	4-6 μm

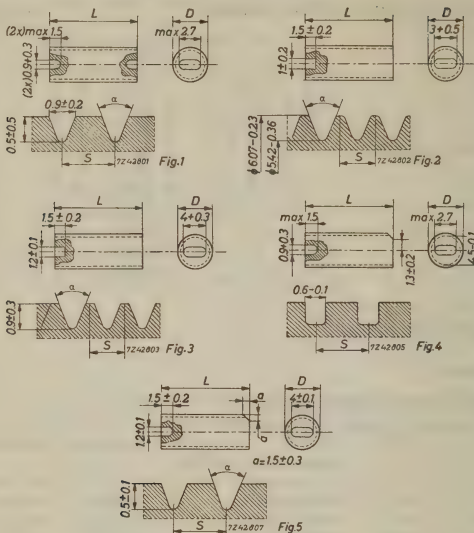
¹⁾ Only for cast parts

Tube

Grade 1P1
 Catalog number:
 322 020 69520



Screw cores



<i>L</i> (mm)	<i>D</i> (mm)	α	<i>S</i> (mm)	<i>tol.</i> ¹⁾ (mm)	<i>n</i>	<i>grade</i>	<i>Fig.</i>	<i>catalog number</i>
5	4.95-0.1	$\leq 85^\circ$	1.5	0.1	1	1P1	1	3122 104 01580
6	6.07-0.23	60°	0.5	—	—	1P1	2	4322 020 69500
8	4.95-0.1	$\leq 85^\circ$	1.5	0.2	4	1P2	1	3122 104 91610
10	7 -0.1	$60^\circ \pm 10^\circ$	1	0.1	1	1P2	3	3122 104 91590
12.25	4.95-0.1	$\leq 85^\circ$	1.5	0.2	5	1P2	1	3122 104 91600
12.25	4.95-0.1	—	1.5	0.05	1	1P1	4	3122 104 93140
12.25	4.95-0.1	$\leq 85^\circ$	1.5	0.2	5	1P1	1	3122 104 90970
13	6.07-0.23	60°	0.5	—	—	1P1	2	3122 104 90990
15	4.95-0.1	$70^\circ + 15^\circ$	1.5	—	—	1P1	1	3122 104 92970
16.5	7 -0.1	60°	1.5	0.05	1	1P2	5	3122 104 91000
16.5	7 -0.1	$60^\circ + 10^\circ$	1	0.1	1	1P2	3	3122 104 91660
20.25	4.95-0.1	$\leq 85^\circ$	1.5	0.2	5	1P1	1	3122 104 90980

¹⁾ Tolerance on S in mm over n grooves

Cores for erasing heads

Material: ferroxcube 3H1

catalogue number number	Fig. no.	L (mm)	B (mm)	p (mm)	b (mm)	H (mm)	D (mm)	d (mm)
3104 101 80400	1	11	3.5	1.5	—	1.9	2.2	4.7
3103 209 12030	2	10.9	3.25	—	2.1	1.7	—	—
3103 209 12040	5	10.9	4.4	2.5	—	1.7	1.7	—
3103 224 90090	4	9	2.6	—	1.8	2.4	—	—
3103 224 90100	3	9	3.5	1.8	2.6	2.4	1.7	—

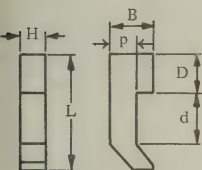


Fig. 1

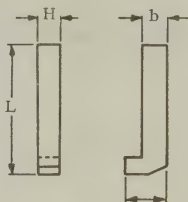


Fig. 2

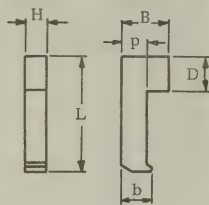


Fig. 3

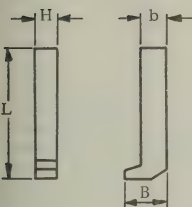


Fig. 4

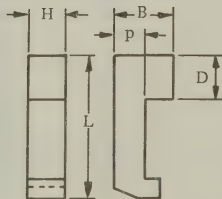
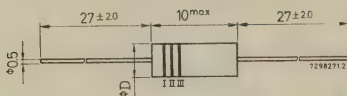


Fig. 5

MICROCHOKES

Dimensions (in mm)



inductance

D

0.1–1000 μH 4 mm

1.5– 100 mH 6.5 mm

Colour code according to I.E.C. publ. 63, but expressed in μH .

nominal inductance (μH)	quality factor		max. d.c. resistance (Ω)	max. C_0 (pF)	catalogue number
	Q	at freq. (MHz)			
0.10	45	25	0.10	1	2422 535 00107
0.15	45	25	0.12	1	2422 535 00157
0.22	45	25	0.14	1	2422 535 00227
0.33	45	25	0.17	1	2422 535 00337
0.47	45	25	0.21	1	2422 535 00477
0.68	45	25	0.25	1	2422 535 00687
1.0	45	25	0.31	1	2422 535 00108
1.5	40	8	0.38	1	2422 535 00158
2.2	40	8	0.45	1	2422 535 00228
3.3	40	8	0.53	1	2422 535 00338
4.7	40	8	0.63	1	2422 535 00478
6.8	40	8	1.00	1	2422 535 00688
10	40	8	1.70	1	2422 535 00109
15	40	2	0.55	1	2422 535 00159
22	40	2	0.70	1	2422 535 00229
33	40	2	0.90	1	2422 535 00339
47	40	2	1.35	1	2422 535 00479
68	40	2	1.6	1	2422 535 00689
100	40	2	1.9	1	2422 535 00101
150	45	0.8	3.5	1	2422 535 00151
220	45	0.8	6.5	1	2422 535 00221
330	45	0.8	11	1	2422 535 00331
470	50	0.8	20	1	2422 535 00471
680	50	0.8	41	1	2422 535 00681
1000	50	0.8	48	1	2422 535 00102
1500	50	0.25	25	4	2422 535 01152
2200	50	0.25	30	4	2422 535 01222
3300	45	0.25	50	4.5	2422 535 01332
4700	45	0.25	60	5	2422 535 01472
6800	40	0.25	75	4.5	2422 535 01682
10000	40	0.1	90	4	2422 535 01103
15000	40	0.1	110	3.5	2422 535 01153
22000	40	0.1	130	3	2422 535 01223
33000	35	0.1	275	3	2422 535 01333
47000	35	0.1	400	3.5	2422 535 01473
68000	30	0.1	470	3.5	2422 535 01683
100000	25	0.1	720	3.5	2422 535 01104

PRE-ADJUSTED FERROXCUBE POTCORES, P-SERIES

Introduction

Ferroxcube potcores have been developed for stable low loss filters, coils and transformers. Due to their closed shape they combine a low weight with a small volume.

The principal properties of a potcore with a given inductance value are the quality factor Q , the temperature coefficient T.F., the disaccommodation factor D.F. and, if the potcore is used on higher induction values, the generation of third harmonics.



<i>application</i>	<i>approximate frequency range</i>	<i>ferroxcube grade</i>
filter coils	from 0.1 to 200 kHz	3B7, 3H1
	200 kHz to 2 MHz	3D3
	2 MHz to 20 MHz	4C6
loading coils, transformers chokes	up to 60 kHz 200 Hz to 10 MHz	3H1 3H1

Potcore dimensions

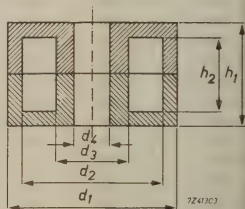
The main dimensions of the potcores are in conformity with the following standardisation specifications:

IEC publication 133

CCTU 06-04 and 06-08 (France)

DIN 41 293 (Germany) and B.S. 4061 (Gr. Britain)

<i>available types</i>	<i>nominal dimensions (mm)</i>					
	d_1	d_2	d_3	d_4	h_1	h_2
P9/5	9.3	7.6	3.8	2.05	5.3	3.45
P11/7	11.1	9.20	4.60	2.05	6.50	4.55
P14/8	14.0	11.8	5.90	3.10	8.40	5.80
P18/11	17.9	15.1	7.45	3.10	10.6	7.40
P22/13	21.5	18.2	9.25	4.50	13.4	9.40
P26/16	25.5	21.6	11.3	5.50	16.0	11.2
P30/19	30.0	25.4	13.3	5.50	18.9	13.2
P36/22	35.5	30.4	15.8	5.50	21.9	14.8
P42/29	42.4	36.3	17.4	5.50	29.4	20.5



Accessories

Coil formers

The dimensions of the coil formers are in conformity with the following standardisation specifications:

IEC publication 133
CCTU 06-02 (France)
DIN 41 294 (Germany)

Inductance adjustors

The inductance of a pre-adjusted potcore can be increased by inserting an adjustor. For each type of potcore the corresponding type of adjustor, which will increase the published μ_e -value by a minimum of 9% and a maximum of 14% approximately is given below. For potcores P26/16, P30/19, P36/22 and P42/29 a series of step-by-step adjustor is available. These adjustors are used when a continuous adjustment of the inductance is not necessary. For instance, they are applied in loading coils to bring the inductance within a certain tolerance.

A range of 13 flexible conical step-by-step adjustors is available under the catalog numbers 4322 021 32000 up to 4322 021 32120. The higher this number the greater the effect. An adhesive is used as sliding and fixing material.

The values of μ_e , α or A_L mentioned in the tables are to be used for the potcores without the adjusting mechanism.

The inductance will only be within the given tolerance if the winding space of the coil former is completely filled.



Coil former



adjustor
with nut



container



spring



tag plate



fixing bush
with nut

Mounting parts

Potcored coils can be mounted on conventional panels, as well as on printed-wiring boards, the location of the soldering tags being matched to the 0.1 in as well as to the 2.50 mm grid. The insulating material of the tag plate can fully withstand the temperatures occurring during dip-soldering.

After placing the spring in the container, the core is brought under the correct pressure by pressing the tag plate down to the rim of the container. It will be held in place after the three ears have been folded over. For conventional panel mounting, a fixing bush and nut are separately available. Types P9/5 and P11/7 do not possess this mounting facility.

Further information on the design of simple tools for potcore assembly will be gladly supplied on request.

For several potcore types coil formers are available provided with p.w. pins, which make the use of mounting parts superfluously.

PRE-ADJUSTED POTCORES P9/5

$$\Sigma \frac{l_e}{A_e} = 12.4 \text{ cm}^{-1}$$

$$V_e = 0.126 \text{ cm}^3$$

Potcores with standard A_L factors

A_L (nH)	corresponding μ_e -value	tolerance on inductance (%)	with nut	catalog number 4322 022 6	
			without nut	catalog number 4322 022 4	
			3B7	3H1	4C6
16	16	± 1	—	—	1800
25	25	± 1	—	—	1810
40	—	± 1	—	—	1820
63	63	± 1	1030	1230	—
100	100	± 1.5	1040	1240	—
160	160	± 2	1050	1250	—

Inductance $L = N^2 A_L$ (in 10^{-9} H)

Coil former

1 section catalog number 4322 021 31700

Continuous inductance adjustors

available types		recommended application	
colour	catalog number	A_L	3B7/3H1/3D3
green	4322 021 31250	63	4322 021 31250
yellow	4322 021 31270	100	4322 021 31270
brown	4322 021 31540	160	4322 021 31540

PRE-ADJUSTED POTCORES P11/7

$$\Sigma \frac{l_e}{A_e} = 9.56 \text{ cm}^{-1} \quad V_e = 0.251 \text{ cm}^3$$

Potcores with standard μ_e -values

μ_e	α	tolerance on induc- tance (%)	catalog number 4322 022 (with nut)			
			3B7	3H1	3D3	4C6
15	225	± 1	—	—	—	20810
22	186	± 1	—	—	—	20820
33	152	± 1	—	—	20430	20830
47	127	± 1	—	—	20440	—
68	105.8	± 1	20050	20250	20450	—
100	87.2	± 1.5	20060	20260	—	—
150	71.2	± 2	20070	20270	—	—
220	58.8	± 5	20080	20280	—	—
660	33.9	± 25	—	—	20400	—
1300	24.2	± 25	20000	20200	—	—

$$\text{Number of turns } N = \alpha \sqrt{L} \text{ (} L \text{ in } 10^{-3} \text{ H)}$$

Potcores with standard A_L -factors

A_L (nH)	corresponding μ_e -value	tolerance on induc- tance (%)	catalog number 4322 022 (with nut)			
			3B7	3H1	3D3	4C6
16	12.2	± 1	—	—	—	21800
25	19.0	± 1	—	—	—	21810
40	30.5	± 1	—	—	21420	21820
63	48	± 1	—	—	21430	—
100	76	± 1	21040	21240	21440	—
160	122	± 1.5	21050	21250	—	—
250	190	± 3	21060	21260	—	—

$$\text{Inductance } L = N^2 A_L \text{ (in } 10^{-9} \text{ H)}$$

Coil former

1 section catalog number 4322 021 30240

Continuous inductance adjusters

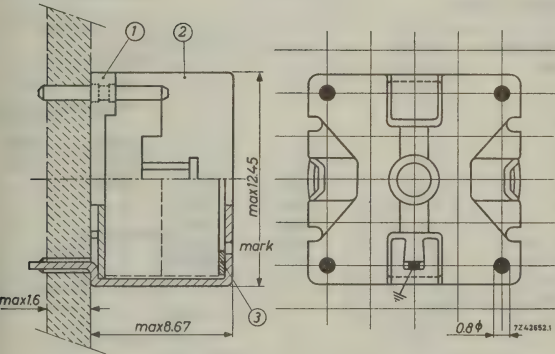
available types

catalog number	colour
4322 021 31250	green
4322 021 31260	red
4322 021 31270	yellow
4322 021 31280	grey
4322 021 31540	brown

recommended application

μ_e	A_L	3B7/3H1/3D3
	40	4322 021 31250
33		4322 021 31250
	63	4322 021 31260
47		4322 021 31260
68		4322 021 31270
	100	4322 021 31270
100		4322 021 31540
150	160	4322 021 31540
	250	4322 021 31280
220		4322 021 31280

Mounting parts



- (1) tag plate 4322 021 30180
- (2) brass container 4322 021 30510
- (3) spring 4322 021 30620

PRE-ADJUSTED POTCORES P14/8

$$\Sigma \frac{l_e}{A_c} = 7.89 \text{ cm}^{-1} \quad V_e = 0.495 \text{ cm}^3$$

Potcores with standard μ_e -values

μ_e	α	tolerance on induc- tance (%)	catalog number 4322 022			
			3B7	3H1	3D3	4C6
15	205	± 1	—	—	—	22810
22	169	± 1	—	—	—	22820
33	137.9	± 1	22030	22230	22430	22830
47	115.5	± 1	22040	22240	22440	—
68	96.1	± 1	22050	22250	22450	—
100	79.2	± 1.5	22060	22260	—	—
150	64.6	± 2	22070	22270	—	—
220	53.3	± 3	22080	22280	—	—
680	30.3	± 25	—	—	02400 ¹⁾	—
1400	21.2	± 25	02000 ¹⁾	02200 ¹⁾	—	—

Number of turns $N = \alpha \sqrt{L}$ (L in 10^{-3} H)

¹⁾ Supplied without nut for adjustor

Potcores with standard A_L -factors

A_L (nH)	corresponding μ_e -value	tolerance on induc- tance (%)	catalog number 4322 022			
			3B7	3H1	3D3	4C6
25	15.7	± 1	—	—	—	23810
40	25	± 1	—	—	23420	23820
63	39.5	± 1	—	—	23430	23830
100	63	± 1	23040	23240	23440	—
160	100.5	± 1.5	23050	23250	—	—
250	157	± 2	23060	23260	—	—
315	198	± 2	23070	23270	—	—
400	252	± 2	—	23280	—	—

Inductance $L = N^2 A_L$ (in 10^{-9} H)

Coil formers

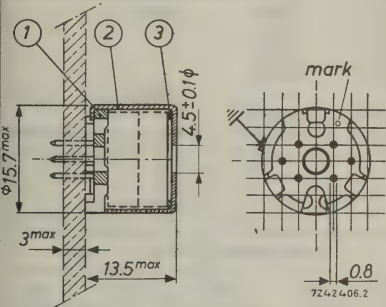
Single section	catalog number 4322 021 30250
Two sections	4322 021 30260
Single section with p.w. pins	4322 021 30070

Continuous inductance adjusters

available types

catalog number	colour
4322 021 30740	red
4322 021 30750	green
4322 021 30940	yellow
4322 021 30950	white
4322 021 31070	brown
4322 021 31130	grey

Mounting on printed-wiring boards

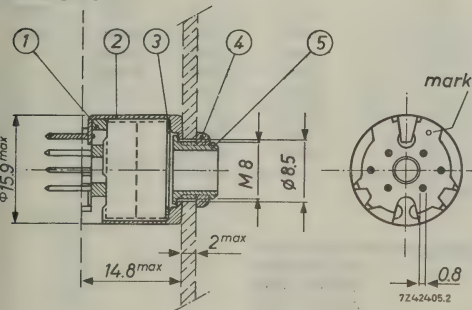


recommended application

μ_e	A_L	cat. number 4322 021	
		3B7/3H1/3D3	4C6
15	—	—	30740
	25	—	30740
22	—	—	30740
	40	30750	30940
33	—	30750	30950
	63	30740	30940
47	—	30740	—
	100	30940	—
68	—	30940	—
100	—	30950	—
	160	30950	—
150	—	31070	—
	250	31070	—
220	—	31130	—
	315	31130	—

- (1) tag plate 4322 021 30440
 (2) brass container 4322 021 30520
 (3) spring 4322 021 30630

Mounting on panels



- (1) tag plate 4322 021 30440
 (2) aluminium container 4322 021 30600
 (3) spring 4322 021 30630
 (4) nut 4322 021 30710
 (5) fixing bush 4322 021 30720

PRE-ADJUSTED POTCORES P18/11

$$\Sigma \frac{l_e}{A_e} = 5.97 \text{ cm}^{-1} \quad V_e = 1.12 \text{ cm}^3$$

Potcores with standard μ_e -values

μ_e	α	tolerance on induc- tance (%)	catalog number 4322 022			
			3B7	3H1	3D3	4C6
15	178	± 1	—	—	—	24810
22	147	± 1	—	—	—	24820
33	120	± 1	24030	24230	24430	24830
47	100.5	± 1	24040	24240	24440	—
68	83.6	± 1	24050	24250	24450	—
100	68.9	± 1.5	24060	24260	—	—
150	56.3	± 2	24070	24270	—	—
220	46.5	± 3	24080	24280	—	—
705	25.9	± 25	—	—	04400 ¹⁾	—
1750	16.5	± 25	04000 ¹⁾	04200 ¹⁾	—	—

Number of turns $N = \alpha \sqrt{L}$ (L in 10^{-3} H)

¹⁾ Supplied without nut for adjustor

Potcores with standard A_L -factors

A_L (nH)	corresponding μ_e -value	tolerance on induc- tance (%)	catalog number 4322 022			
			3B7	3H1	3D3	4C6
25	11.9	± 1	—	—	—	25810
40	19.0	± 1	—	—	25420	25820
63	30.0	± 1	25030	25230	25430	25830
100	47.5	± 1	25040	25240	25440	—
160	76	± 1	25050	25250	25450	—
250	119	± 1.5	25060	25260	—	—
315	149	± 2	25070	25270	—	—
400	190	± 2	25080	25280	—	—
630	298	± 3	25100	25300	—	—

Inductance $L = N^2 A_L$ (in 10^{-9} H)

Coil formers

single section	catalog number 4322 021 30270
two sections	4322 021 30280
three sections	4322 021 30290
single section, with p.w. pins	4322 021 30090

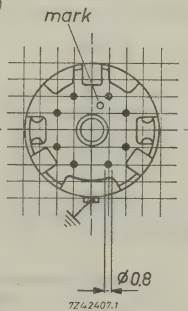
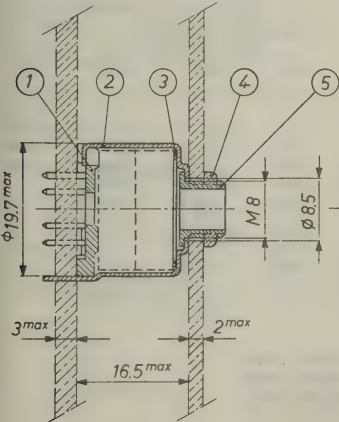
Continuous inductance adjusters

available types

catalog number	colour
4322 021 30730	brown
4322 021 30760	green
4322 021 30770	red
4322 021 30960	yellow
4322 021 30970	white
4322 021 31080	grey

Mounting on P.W. board or on panel

- (1) tag plate 4322 021 30450
- (2) brass container 4322 021 30530
- (3) spring 4322 021 30640
- (4) nut 4322 021 30710
- (5) fixing bush 4322 021 30720



recommended application

μ_e	A_L	cat. number 4322 021	
		3B7/3H1/3D3	4C6
15	—	—	30760
	25	—	30760
	40	—	30770
22	—	—	30770
	63	30760	—
33	—	30760	30970
	100	30770	—
47	—	30770	—
68	—	30960	—
	160	30960	—
	250	30970	—
100	—	30970	—
150	—	30730	—
	400	31080	—
220	—	31080	—
	630	31080	—

PRE-ADJUSTED POTCORES P22/13

$$\Sigma \frac{l_e}{A_e} = 4.97 \text{ cm}^{-1} \quad V_e = 2.00 \text{ cm}^3$$

Potcores with standard μ_e -values

μ_e	α	tolerance on induc- tance (%)	catalog number 4322 022			
			3B7	3H1	3D3	4C6
15	162	± 1	—	—	—	26810
22	134	± 1	—	—	—	26820
33	109.4	± 1	—	—	26430	26830
47	91.7	± 1	—	—	26440	—
68	76.2	± 1	26050	26250	26450	—
100	62.8	± 1.5	26060	26260	—	—
150	51.3	± 2	26070	26270	—	—
220	42.4	± 3	26080	26280	—	—
330	34.6	± 3	26090	26290	—	—
720	23.4	± 25	—	—	06400 ¹⁾	—
1840	14.6	± 25	06000 ¹⁾	06200 ¹⁾	—	—

Number of turns $N = \alpha \sqrt{L}$ (L in 10^{-3} H)

¹⁾ Supplied without nut for adjustor

Potcores with standard A_L -factors

A_L (nH)	corresponding μ_e -value	tolerance on induc- tance (%)	catalog number 4322 022			
			3B7	3H1	3D3	4C6
25	9.9	± 1	—	—	—	27810
40	15.8	± 1	—	—	—	27820
63	25	± 1	—	—	27430	27830
100	39.5	± 1	27040	27240	27440	27840
160	63.5	± 1	27050	27250	27450	—
250	99	± 1.5	27060	27260	27460	—
315	124.5	± 2	27070	27270	—	—
400	158	± 2	27080	27280	—	—
630	249	± 3	27100	27300	—	—
1000	395	± 3	27110	27310	—	—

Inductance $L = N^2 A_L$ (in 10^{-9} H)

Coil formers

single section	catalog number 4322 021 30300
two sections	4322 021 30310
three sections	4322 021 30320
single section, with p.w. pins	4322 021 30110

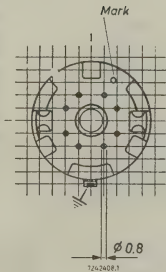
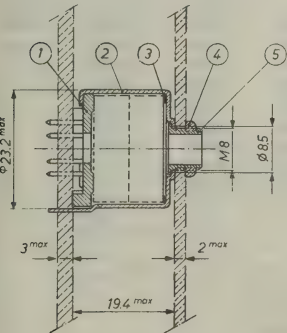
Continuous inductance adjusters

available types

catalog number	colour
4322 021 31000	yellow
4322 021 31020	white
4322 021 31040	green
4322 021 31060	red
4322 021 31100	brown
4322 021 31240	black

Mounting on P.W. board or on panel

- (1) tag plate 4322 021 30460
- (2) brass container 4322 021 30540
- (3) spring 4322 021 30650
- (4) nut 4322 021 30710
- (5) fixing bush 4322 021 30720



recommended application

μ_e	A_L	cat. number 4322 021	
		3B7/3H1/3D3	4C6
	25	—	31060
15	—	—	31060
	40	—	31060
22	—	—	31000
	63	31040	31000
33	—	31040	31020
	100	31060	—
47	—	31060	—
68	—	31000	—
	160	31000	—
	250	31020	—
100	—	31020	—
	315	31020	—
150	—	31100	—
	400	31100	—
220	—	31100	—
	630	31100	—
330	—	31240	—

PRE-ADJUSTED POTCORES P26/16

$$\Sigma \frac{l_e}{A_e} = 4.00 \text{ cm}^{-1} \quad V_e = 3.53 \text{ cm}^3$$

Potcores with standard μ_e -values

μ_e	α	tolerance on induc- tance (%)	catalog number 4322 022			
			3B7	3H1	3D3	4C6
15	146	± 1	—	—	—	28810
22	120	± 1	—	—	—	28820
33	98.2	± 1	28030	28230	28430	28830
47	82.3	± 1	28040	28240	28440	—
68	68.4	± 1	28050	28250	28450	—
100	56.4	± 1.5	28060	28260	—	—
150	46.1	± 2	28070	28270	—	—
220	38.1	± 3	28080	28280	—	—
330	31.0	± 3	28090	28290	—	—
730	20.8	± 25	—	—	08400 ¹⁾	—
1910	12.9	± 25	08000 ¹⁾	08200 ¹⁾	—	—

Number of turns $N = \alpha \sqrt{L}$ (L in 10^{-3} H)

¹⁾ Supplied without nut for adjustor

Potcores with standard A_L -factors

A_L (nH)	corresponding μ_e -value	tolerance on induc- tance (%)	catalog number 4322 022			
			3B7	3H1	3D3	4C6
63	20	+ 1	29030	29230	39430	29830
100	31.8	± 1	29040	29240	29440	29840
160	51	± 1	29050	29250	29450	—
250	79.5	± 1	29060	29260	29460	—
315	100.2	± 1.5	29070	29270	—	—
400	127	± 2	29080	29280	—	—
630	200	± 3	29100	29300	—	—
1000	318	± 3	29110	29310	—	—
1600	510	± 3	29120	29320	—	—

Inductance $L = N^2 A_L$ (in 10^{-9} H)

Coil formers

single section	catalog number 4322 021 30330
two sections	4322 021 30340
three sections	4322 021 30350
single section, with p.w. pins	4322 021 30130

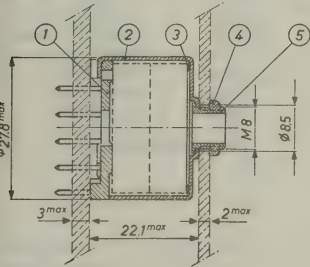
Continuous inductance adjusters

available types

catalog number	colour
4322 021 30780	green
4322 021 30790	yellow
4322 021 30800	red
4322 021 30810	brown
4322 021 30980	white
4322 021 31090	grey

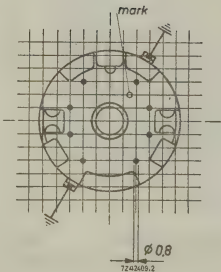
Mounting on P.W. board or on panel

- (1) tag plate 4322 021 30470
- (2) brass container 4322 021 30550
- (3) spring 4322 021 30660
- (4) nut 4322 021 30710
- (5) fixing bush 4322 021 30720



recommended application

μ_e	A_L	cat. number 4322 021	
		3B7/3H1/3D3	4C6
15	—	—	30780
22	—	—	30780
	63	—	30780
33		30780	30790
	100	30780	30790
47		30800	
	160	30800	
68		30980	
	250	30980	
100	315	30980	
150		30810	
	400	30810	
220		30810	
	630	30810	
330		31090	
	1000	31090	



PRE-ADJUSTED POTCORES P30/19

$$\Sigma \frac{l_e}{A_e} = 3.30 \text{ cm}^{-1} \quad V_e = 6.19 \text{ cm}^3$$

Potcores with standard μ_e -values

μ_e	α	tolerance on inductance (%)	catalog number 4322 022		
			3B7	3H1	3D3
33	89.2	± 1	30030	30230	30430
47	74.7	± 1	—	—	30440
68	62.1	± 1	30050	30250	30450
100	51.3	± 1.5	30060	30260	—
150	41.8	± 2	30070	30270	—
220	34.6	± 3	30080	30280	—
330	28.2	± 3	30090	30290	—
740	18.9	± 25	—	—	10400 ¹⁾
1990	11.5	± 25	10000 ¹⁾	10200 ¹⁾	—

Number of turns $N = \alpha \sqrt{L}$ (L in 10^{-3} H)

¹⁾ Supplied without nut for adjustor

Potcores with standard A_L -factors

A_L (nH)	corresponding μ_e -value	tolerance on inductance (%)	catalog number 4322 022		
			3B7	3H1	3D3
100	26.2	± 1	—	—	31440
160	42	± 1	—	—	31450
250	65.5	± 1	31060	31260	31460
400	105	± 1.5	31080	31280	—
630	165	± 2	31100	31300	—
1000	263	± 3	31110	31310	—
1600	420	± 3	31120	31320	—

Inductance $L = N^2 A_L$ (in 10^{-9} H)

Coil formers

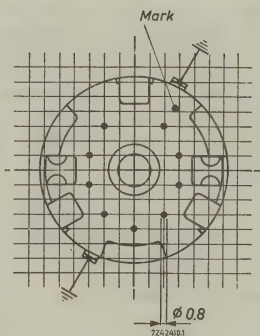
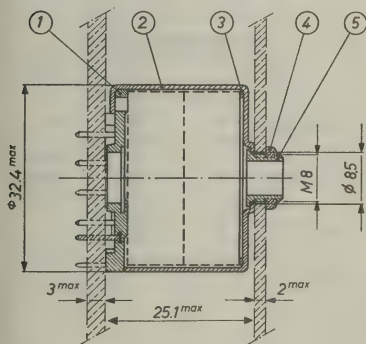
Single section	catalog number 4322 021 30360
two sections	4322 021 30370
three sections	4322 021 30380

Continuous inductance adjusters

Available types and recommended applications

colour	catalog number 4322 021	potcore	
		μ_e	A_L
green	30780	33	100
red	30800	47	160
white	30980	68	250
white	30980	100	400
brown	30810	150	630
grey	31090	220	1000
black	31120	330	1600

Mounting on P.W. board or on panel



- (1) tag plate 4322 021 30480
- (2) brass container 4322 021 30560
- (3) spring 4322 021 30670

- (4) nut 4322 021 30710
- (5) fixing bush 4322 021 30720

PRE-ADJUSTED POTCORES P36/22

$$\Sigma \frac{l_e}{A_e} = 2.64 \text{ cm}^{-1} \quad V_e = 10.7 \text{ cm}^3$$

Potcores with standard μ_e -values

μ_e	α	tolerance on inductance (%)	catalog number 4322 022		
			3B7	3H1	3D3
33	79.7	± 1	—	—	32430
47	66.8	± 1	—	—	32440
68	55.6	± 1	32050	32250	32450
100	45.8	± 1.5	32060	32260	—
150	37.4	± 2	32070	32270	—
220	30.9	± 3	32080	32280	—
330	25.2	± 25	32090	32290	—
750	16.7	± 25	—	—	12400 ¹⁾
2030	10.2	± 25	12000 ¹⁾	12200 ¹⁾	—

Number of turns $N = \alpha \sqrt{L}$ (L in 10^{-3} H)

¹⁾ Supplied without nut for adjustor

Potcores with standard A_L -factors

A_L (nH)	corresponding μ_e -value	tolerance on induc- tance (%)	catalog number 4322 022		
			3B7	3H1	3D3
40	8.39	± 1	33020	33220	—
100	21	± 1	33040	33240	—
160	33.6	± 1	—	—	33450
250	52.5	± 1	33060	33260	33460
400	84	± 1.5	33080	33280	33480
630	132	± 2	33100	33300	—
1000	210	± 3	33110	33310	—
1600	336	± 3	33120	33320	—

Inductance $L = N^2 A_L$ (in 10^{-9} H)

Coil formers

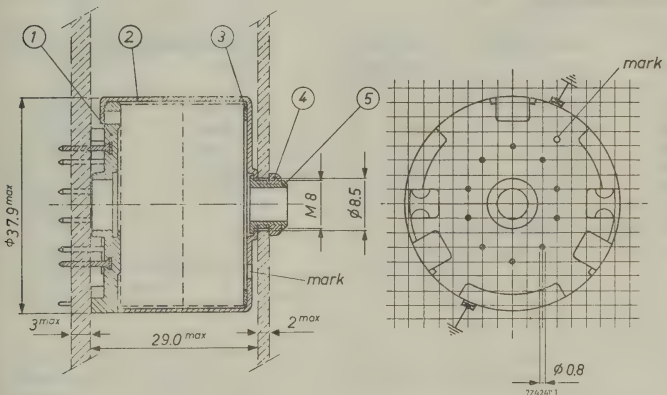
single section	catalog number	4322 021 30390
two sections		4322 021 30400
three sections		4322 021 30410

Continuous inductance adjusters

Available types and recommended applications for potcores with grade 3B7, 3H1 and 3D3

colour	catalog number	potcore	
		μ_e	A_L
yellow	30790	33	160
white	30980	47	250
white	30980	68	—
brown	30810	100	400
brown	30810	—	630
grey	31110	150	—
grey	31090	220	1000
black	31120	330	1600

Mounting on P.W. board or on panel



- | | | | |
|---------------------|----------------|-----------------|----------------|
| (1) tag plate | 4322 021 30490 | (4) nut | 4322 021 30710 |
| (2) brass container | 4322 021 30570 | (5) fixing bush | 4322 021 30720 |
| (3) spring | 4322 021 30680 | | |

PRE-ADJUSTED POTCORES P42/29

$$\Sigma \frac{l_e}{A_e} = 2.59 \text{ cm}^{-1} \quad V_e = 18.2 \text{ cm}^3$$

Potcores with standard μ_e -values

μ_e	α	tolerance on inductance (%)	catalog number 4322 022	
			3B7	3H1
33	78.4	± 1	—	—
47	65.7	± 1	—	—
68	55.0	± 1	—	34250
100	45.0	± 1.5	34060	34260
150	36.8	± 2	34070	34270
220	30.4	± 3	34080	34280
330	24.8	± 3	34090	34290
2120	9.85	± 25	14000 ¹⁾	14200 ¹⁾

Number of turns $N = \alpha \sqrt{L}$ (L in 10^{-3} H)

¹⁾ Supplied without nut for adjustor

Potcores with standard A_L -factors

A_L (nH)	corresponding μ_e -value	tolerance on inductance (%)	catalog number 4322 020	
			3B7	3H1
250	51	± 1	35060	35260
400	81	± 1	35080	35280
630	130	± 2	35100	35300
1000	205	± 3	35110	35310
1600	325	± 3	35120	35320

Inductance $L = N^2 A_L$ (in 10^{-9} H)

Coil formers

single section catalog number 4322 021 30420

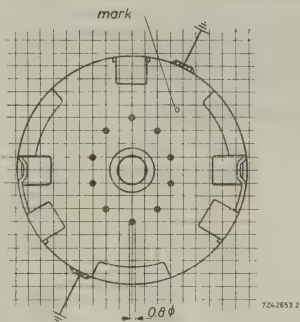
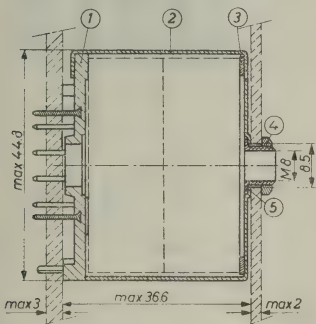
two sections 4322 021 30430

Continuous inductance adjusters

Available types and recommended applications

colour	catalog number	potcore	
		μ_e	A_L
white	30980	68	250
brown	30810	100	400
brown	30810	—	630
grey	31090	150	1000
grey	31090	220	—
black	31120	330	1600

Mounting on P.W. board or on panel



(1) tag plate 4322 021 30500

(2) brass container 4322 021 30580

(3) spring 4322 021 30690

(4) nut 4322 021 30710

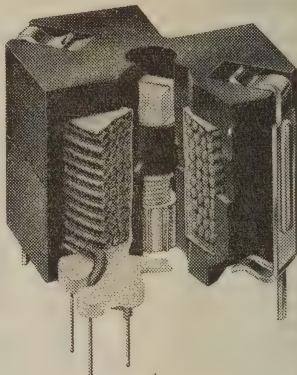
(5) fixing bush 4322 021 30720

PRE-ADJUSTED FERROXCUBE SQUARE CORES

Assembly

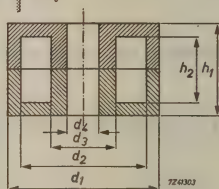
Main dimensions

available types	nominal dimensions (mm)					
	d_1 max	d_2 min	d_3 max	d_4 min	h_1 max	h_2 min
RM4	9.8	8.0	3.9	2.0	10.5	7.0
RM5	12.3	10.2	4.9	2.0	10.5	6.3
RM6R	14.7	12.4	6.4	3.0	12.5	8.0
RM6S	14.7	12.4	6.4	3.0	12.5	8.0
RM8	19.7	17.0	8.9	4.4	16.5	10.8



PRE-ADJUSTED SQUARE CORES RM4

	with centre hole	without centre hole
$\sum \frac{l_e}{A_e}$	19.4 cm^{-1}	16.9 cm^{-1}
V_e	0.23 cm^3	0.32 cm^3



Cores with standard A_L factors

A_L	corresponding μ_e -value	tolerance on inductance (%)	cat. No.					
			4322 022 7 with nut			4322 022 5 without nut		
			3B7	3H1	3D3	4C6	impr. 3E1	3E4
16	24.2	± 1	—	—	7400	7800		
25	38	± 1	—	—	7410	7810		
40	62	± 1	7020	7220	7420	—		
63	96	± 1.5	7030	7230	7430			
100	152	± 2	7040	7240	—	—		
160	242	± 5	7050	7250	—	—		
250	380	± 10	7060	7260	—	—		
		± 25	—	—	—	—	7700*)	
2950	4500	± 25	—	—	—	—	—	7900*)

Inductance $L = N^2 A_L$ (in 10^{-9} H)

*) Only available without nut for adjuster

Coil former

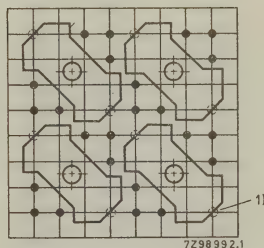
sections	pins	catalog number
1	6	4322 021 31800

Inductance adjusters

A_L of core in 3B7/3H1	recommended adjuster	
	catalog number	colour
16		
25		
40	4322 021 31250	green
63	4322 021 31260	red
100	4322 021 31270	yellow
160	4322 021 31540	brown
250	4322 021 31280	grey

Mounting

The core halves are clamped together by means of two clips, type 4322 021 31900. The hooked ends of either clip fall into recesses made in the core halves. The clips are also used for mounting the assembled core on a printed-wiring board, see Fig. The soldering pins of coil formers and clips are so arranged that they will fit printed-wiring board with a 0.1 in grid as well as those with a 2.50 mm grid. The pin length is sufficient for a board thickness of up to 2.4 mm.



¹⁾ Holes for tag on clip 4322 021 31900 (earth points)

PRE-ADJUSTED SQUARE CORES RM5

	with centre hole	without centre hole
$\sum \frac{l_e}{A_e}$	10.1 cm ⁻¹	9.35 cm ⁻¹
V_e	0.45 cm ³	0.57 cm ³

Cores with standard A_L factors

A_L	corre- sponding μ_e -value	tol. on induct- ance (%)	cat. No. 4322 022 7 with nut 4322 022 5 without nut					
			3B7	3H1	3D3	4C6	impr. 3E1	3E4
16	13	±1	—	—		9800		
25	20	±1	—	—	9410	9810		
40	33	±1	—	—	9420	9820		
63	51	±1	9030	9230	9430	9830		
100	72	±1	9040	9240	9440			
160	130	±2	9050	9250				
250	200	±3	9060	9260				
315	250	±5	9070	9270				
400	330	±5	9080	9280				
3450	2570	±25	—	—	—		9900 ¹⁾	
4975	3700	±25	—	—	—	—	—	9990 ¹⁾

Inductance $L = N^2 A_L$ (in 10⁻⁹ H)

¹⁾ Version without central hole, only available without nut for adjuster.

Coil former

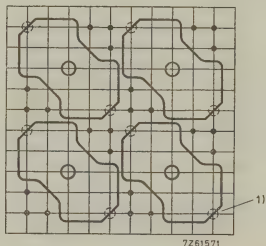
sections	pins	catalog number
1	6	4322 021 31860

Inductance adjusters

A_L of core in	recommended adjuster	
3B7/3H1/3D3	catalog number	colour
16		
25		
40	4322 021 31250	green
63	4322 021 31260	red
100	4322 021 31270	yellow
160	4322 021 31540	brown
250	4322 021 31280	grey

Mounting

The core halves are clamped together by means of two clips, type 4322 021 31900. The hooked ends of either clip fall into recesses made in the core halves. The clips are also used for mounting the assembled core on a printed-wiring board, see Fig. The soldering pins of coil formers and clips are so arranged that they will fit printed-wiring boards with a 0.1 in grid as well as those with a 2.50 mm grid. The pin length is sufficient for a board thickness of up to 2.4 mm.



¹⁾ Holes for tag on clip 43 021 31900 (earth points).

PRE-ADJUSTED SQUARE CORES RM6-R

$$\sum \frac{l_e}{A_e} = 7.84 \text{ cm}^{-1} \quad V_e = 0.799 \text{ cm}^3$$

Cores with standard A_L factors

A_L	corre- sponding μ_e	tol. on induct- ance (%)	cat. No.		4322 022 7 with nut			4322 022 5 without nut	
			3B7	3H1	3D3	4C6	3E4	impr. 3E1	
25	15.6	± 1				5810			
40	24.9	± 1	5020	5220	5420	5820			
63	39.4	± 1	5030	5230	5430	5830			
100	62.4	± 2	5040	5240	5440				
160	100	± 2	5050	5250	5450				
200	122	± 2	5170	5370					
250	156	± 2	5060	5260					
315	197	± 2	5070	5270					
400	249	± 2	5080	5280					
630	394	± 3	5100	5300					
1000	624	± 10	5110	5310					
1250	780	± 10	5190	5390					
2700	1690	± 25	5000	5200					
4750	3000	± 25	—	—	—	—	—	5800*	
6000	3750	± 25	—	—	—	—	5900*		

Inductance $L = N^2 A_L$ (in 10^{-9} H)

* Only available without nut for adjuster

Coil formers

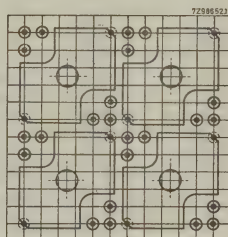
sections	pins	catalog number
1	4	4322 021 31720
1	6	4322 021 31710
2	4	4322 021 31740
2	6	4322 021 31730

Inductance adjusters

A_L of core in 3B7/3H1/3D3	recommended adjuster	
	cat. No.	colour
160	4322 021 30970	white
200	4322 021 30970	white
250	4322 021 30730 or 4322 021 30970	brown white
315	4322 021 30730	brown
400	4322 021 30730	brown
630	4322 021 31080	grey

Mounting

The core halves are clamped together by means of two clips, type 4322 021 31780. The hooked ends of either clip fall into recesses made in the core halves. The clips are also used for mounting the assembled core on a printed wiring board, see example in Fig. The soldering pins of coil formers and clips are so arranged that they will fit printed-wiring boards with a 0.1 in grid as well as those with a 2.50 mm grid. The pin length is sufficient for a board thickness of up to 2.4 mm.



¹⁾

¹⁾ Holes for tag on clip 4322 021 31780 (earth points).

PRE-ADJUSTED SQUARE CORES RM6-S

$$\sum \frac{l_e}{A_e} = 8.6 \text{ cm}^{-1} \quad V_e = 0.84 \text{ cm}^3$$

Cores with standard A_L factors

A_L	corre- sponding μ_e value	tol. on induct- ance (%)	cat. No.	4322 022 6 with nut					4322 022 4 without nut	
				3B7	3H1	3D3	4C6	3E4	impr. 3E1	
25	17.1	± 1					7810			
40	27.4	± 1				7420	7820			
63	43.1	± 1				7430	7830			
100	62.0	± 2				7440				
160	110	± 2	7050	7250	7450					
200	137	± 2	7060	7350						
250	171	± 2	7060	7260						
315	216	± 2	7070	7270						
400	274	± 2	7080	7280						
630	431	± 3	7100	7300						
1000	620	± 10	7110	7310						
1250	856	± 10	7190	7390						
2500	1710	—	7000	7200						
4400	3010	± 25			—	—	—		7800*	
5500	3770	± 25	—	—	—	—	—	7900*	—	

Inductance $L = N^2 A_L$ (in 10^{-9} H)

* Only available without nut for adjuster

Coil formers

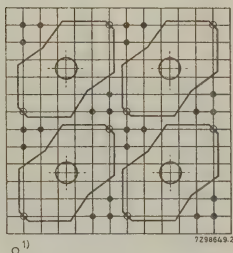
sections	pins	catalog number
1	4	4312 021 29240
1	6	4312 021 29250

Inductance adjusters

A_L of core	recommended adjuster	
	catalog number	colour
160	4322 021 30960	yellow
250	4322 021 30970	white
315, 400	4322 021 30730	brown
630	4322 021 31080	grey

Mounting

The core halves are clamped together by means of two clips, type 4322 021 31780. The hooked ends of either clip fall into recesses made in the core halves. The clips are also used for mounting the assembled core on a printed-wiring board, see example in Fig. The soldering pins of coil formers and clips are so arranged that they will fit printed-wiring boards with a 0.1 in grid as well as those with a 2.50 mm grid. The pin length is sufficient for a board thickness of up to 2.4 mm.



¹⁾ Holes for tag on clip 4322 021 31780 (earth points).

PRE-ADJUSTED SQUARE CORES RM8

	with central hole	without central hole
$\sum \frac{l_e}{A_e}$	6.82 cm ⁻¹	6.04 cm ⁻¹
V_e	1.85 cm ³	2.44 cm ³

Cores with standard A_L factors

A_L	corre- sponding μ_e -value	tol. on induct- ance (%)	cat. No.	4322 022 7 with nut				
				4322 022 5 without nut				
			3B7	3H1	3D3	4C6	impr. 3E1	3E4
40	22	±1	—	—	1420	1820		
63	34	±1	—	—	1430	1830		
100	54	±1	—	—	1440	1840		
160	88	±1.5	1050	1250	1450	1850		
250	135	±2	1060	1260				
315	170	±2	1070	1270				
400	220	±3	1080	1280				
630	340	±3	1100	1300				
1000	540	±10	1110	1310				
1250	680	±10	1190	1390				
6300	3050	±25	—	—	—	—	1800 ¹⁾	
8000	3850	±25	—	—	—	—	—	1900 ¹⁾

Inductance $L = N^2 A_L$ (in 10⁻⁹ H)

¹⁾ Version without central hole, only available without nut for adjuster

Coil formers

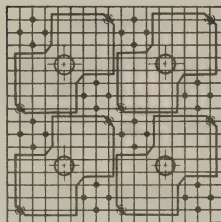
<i>sections</i>	<i>pins</i>	<i>catalog number</i>
1	4	4322 021 31780
1	8	4322 021 31880
1	12	4322 021 31890

Inductance adjusters

<i>A_L of core in 3B7/ 3H1/3D3</i>	<i>recommended adjuster</i>	
	<i>catalog number</i>	<i>colour</i>
40		
63		
100		
160	31000	yellow
250	31020	white
315	31100	brown
400	31100	brown
630	31240	black

Mounting

The core halves are clamped together by means of two clips, type 4322 021 31840. The hooked ends of either clip fall into recesses made in the core halves. The clips are also used for mounting the assembled core on a printed-wiring board, see example in Fig. The soldering pins of coil formers and clips are so arranged that they will fit printed-wiring boards with a 0.1 in grid as well as those with a 2.50 mm grid. The pin length is sufficient for a board thickness of up to 2.4 mm.



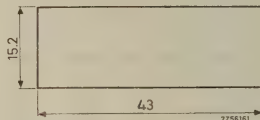
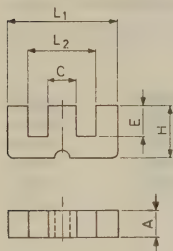
⊗ 1)

1) Holes for tag on clip 4322 021 31840

TRANSFORMER CORES

E- and I-cores

These cores are typical transformer cores. They can be used from voice frequencies up to some MHz.



type	dimensions						ferroxcube grade	air gap (mm)	catalog number
	L ₁	L ₂	C	A	H	E			
E13/7/3	12.95	9.43	3.3	3.3	6.7	4.95	3H7	0	4322 020 34510
E20/10/5	20.7	12.8	5.2	5.3	10	6.3	3E1	0	4322 020 34530
								0.15	34550
							improved 3E1	0	34830
E30/15/7	30.8	19.5	7.2	7.3	15	9.7	3E1	0	4322 020 34630
								0.15	34650
								0.30	34660
							improved 3E1	0	34840
E42/21/15	43	29.5	12.2	15.2	21	14.8	3E1	0	4322 020 34720
								0.25	34740
								0.5	34750
							improved 3E1	0	34850
I42/7.5/15	see figure above						3E1	0	4322 020 37320
E55/28/21	56.2	37.5	17.2	21	27.5	18.5	3E1	0	4322 020 34780
E65/32/13	66.5	44.2	20	13.7	32.5	22.2	3E1	0	4322 020 34820

The dimensions are according to D.I.N. 41295

With two E-cores or one E-core and one I-core a shell type transformer can be composed.

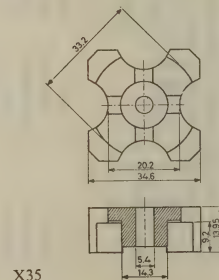
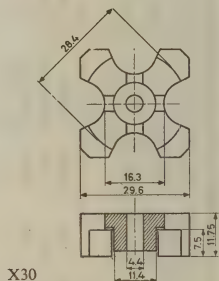
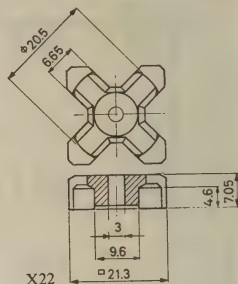
shell type transformer	composed of	A_e (cm^2)	$\Sigma \frac{l_e}{A_e}$ (cm^{-1})	V_c (cm^3)	μ_e	A_L (nH)	cat. number of coil former without pins 4312 021	cat. number of coil former with pins 4322 021
13/13/3	2 × E13/7/3	0.101	30.9	0.318	≥ 1390	≥ 566		
20/20/5	2 × E20/10/5	0.312	13.7	1.34	1650–2760	1515–2520	28431	20240
30/30/7	2 × E30/15/7	0.597	11.2	4.00	1795–2990	2010–3350	28550	20250
42/42/15	2 × E42/21/15	1.82	5.34	17.6	1910–3140	4425–7380	28622	21830
42/29/15	1 × E42/21/15 + 1 × I42/7.5/15	1.83	3.67	12.3	> 1820	> 6300		
55/55/21	2 × E55/28/21	3.54	3.48	43.7	1950–3250	7050–11700	28711	
65/65/27	4 × E65/32/13	5.32	2.75	78.2	1835–3050	8400–14000	28721	

TRANSFORMER CORES

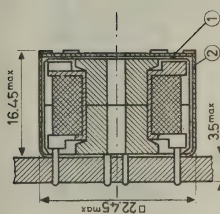
Cross cores

These cores have been developed for transformers to be used on printed-wiring boards. The soldering pins are positioned according to a grid of 2.52 mm.

core half	ferroxcube grade	air gap (mm)	catalog number
X22	3E1	0	3522 200 03470
		0.15	4322 020 23700
	improved 3E1	0	4322 020 23530
	3H1	0	4322 020 23510
		0.02	4322 020 23710
		0.05	4322 020 23720
		0.15	4322 020 23730
		0.25	4322 020 23740
	3B7	0	3522 200 08770
	3D3	0	3522 200 03480
	4C6	0	3522 200 03490
X30	improved 3E1	0	4322 020 23760
	3H1	0	4322 020 23750
		0.02	4322 020 23960
		0.05	4322 020 23970
		0.15	4322 020 23980
		0.25	4322 020 23990
X35	3H1	0	4322 020 24000
		0.02	4322 020 24210
		0.05	4322 020 24220
		0.15	4322 020 24230
		0.25	4322 020 24240

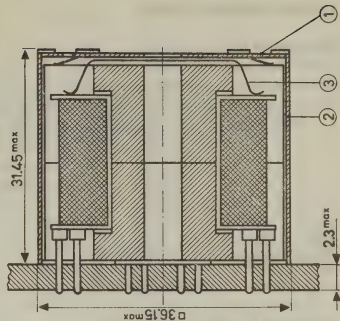


Cross- core	ferroxcube grade	A_e (cm^2)	$\Sigma \frac{l_e}{A_e}$ (cm^{-1})	V_e (cm^3)	μ_e	catalog number of coil former
X22	3E1	0.66	5.75	2.51	≥ 1495	4322 021 31770
	improved				2000—	
	3E1	0.66	5.75	2.51	3325	
	3H1	0.66	5.75	2.51	≥ 1440	
	3B7	0.66	5.75	2.51	≥ 1440	
	3D3	0.66	5.75	2.51		
	4C6	0.66	5.75	2.51		
X30	improved				2200—	4322 021 31190
	3E1	1.14	4.90	6.36	3675	
	3H1	1.14	4.90	6.36	≥ 1525	
X35	3H1	1.64	4.10	11.0	≥ 1580	{ 4322 021 31200 (16 pins) 4322 021 30190 (8 pins)



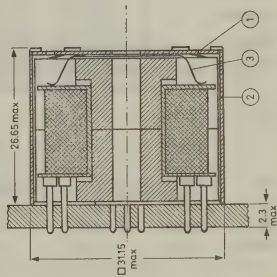
Core assembly X22

- (1) Cover 4322 021 30230
(2) Container 4322 021 30040



Core assembly X35

- (1) Cover 4322 021 31160
(2) Container 4322 021 31180
(3) Spring 4322 021 30220



Core assembly X30

- (1) Cover 4322 021 31150
(2) Container 4322 021 31170
(3) Spring 4322 021 30210

TRANSFORMER CORES

Pre-adjusted cross cores X22

Cross cores with standard A_L factors

A_L	corresponding μ_c -value	tolerance on induc- tance (%)	catalog number 4322 022 6 . . . , with nut 4322 022 4 . . . , without nut
<i>ferroxcube grade 3H1</i>			
160	73	± 1	5250
250	115	± 1.5	5260
400	180	± 2	5280
630	290	± 3	5300

Inductance $L = N^2 A_L$ (in 10^{-9} H)

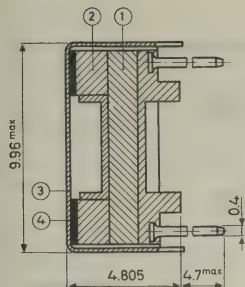
Inductance adjusters

A_L of core in 3H1	recommended adjuster	
	catalog number	colour
160	4322 021 30970	white
250	4322 021 30970	white
	4322 021 30730	brown
400	4322 021 30730	brown
	4322 021 31080	grey
630	4322 021 31080	grey
1000	4322 021 31080	grey

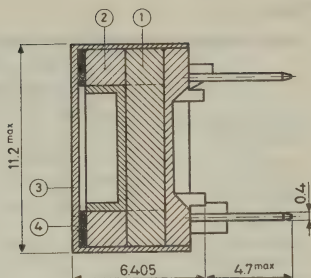
H-cores

These cores have been developed for small transformers to be used on printed-wiring boards. The soldering pins are positioned according to a grid of 2.52 mm. The material grade is FXC3E2.

type	A_e (cm^2)	$\Sigma \frac{l_e}{A_e}$ (cm^{-1})	V_e (cm^3)	μ_e	A_L (nH)	catalog number
H7	0.0325	54	0.0571	≥ 3000	≥ 700	4322 020 33020
H10	0.075	30	0.17	≥ 3820	≥ 1600	4322 020 33010
H16	0.349	10.2	1.24		> 4500	4322 020 33030
H20	0.47	8.8	1.93	≥ 3850	≥ 5500	4322 020 33000

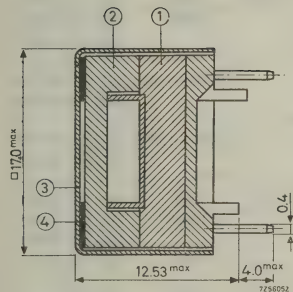


Core assembly H7
Max. length = 7.46 mm

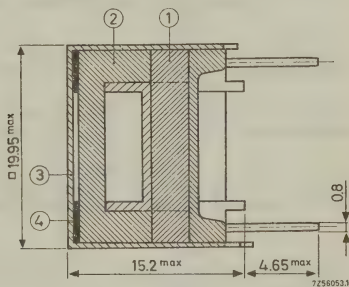


Core assembly H10
Max. length = 12.4 mm

- (1) Ferroxcube H-shape with reinforced polyester coil former
- (2) Ferroxcube window
- (3) Brass container
- (4) Silicon rubber washer



Core assembly H16



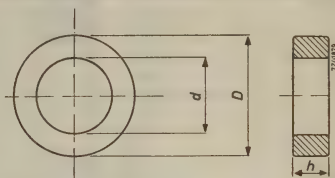
Core assembly H20

- (1) Ferroxcube H-shape with reinforced polyester coil former
- (2) Ferroxcube U-shape
- (3) Brass container
- (4) Silicon rubber washer

TRANSFORMER CORES

Toroids

Toroids are mainly used in broadband transformers, pulse transformers and chokes.



dimensions (mm) $D \times d \times h$	ferroxcube grade	l_e (cm)	$\sum \frac{l_e}{A_e}$ (cm ⁻¹)	V_e (cm ³)	μ_{tor}	catalog number
$2 \times 1.3 \times 0.7$	3E3	0.511	208	0.00125	> 10 000	8222 293 03230
$3.93 \times 2.23 \times 1.27$	3E3		87.4		10000–15000	4322 020 90780
	3B7					4322 020 90820
$4 \times 2.2 \times 1.1$	3E2	0.946	95.6	0.00937	> 5000	4322 020 36650
	3E3				> 10000	4322 020 36700
	3H1				1)	4322 020 36590
$4.83 \times 2.28 \times 1.27$	3E3		66.3		10000–15000	4322 020 90790
	3B7					4322 020 90830
$5.84 \times 3.05 \times 1.52$	3E3		63.4		10000–15000	4322 020 90800
	3B7					4322 020 90840
$6 \times 4 \times 2$	3E2	1.55	77.5	0.0310	> 5000	4322 020 36660
	3E3				> 10000	4322 020 36710
	3H1				1)	4322 020 36600
	4C6				> 100	4322 020 36500
$9 \times 6 \times 3$	3E2	2.33	51.7	0.105	> 5000	4322 020 36670
	3E3				> 10000	4322 020 36720
	3H1				1)	4322 020 36610
	4C6				> 100	4322 020 91010

<i>dimensions (mm)</i> <i>D × d × h</i>	<i>ferroxcube</i> <i>grade</i>	<i>l_e</i> (cm)	$\sum \frac{l_e}{A_e}$ (cm ⁻¹)	<i>V_e</i> (cm ³)	<i>μ_{tor}</i>	<i>catalog number</i>
9.53 × 4.75 × 3.18	3E3 3B7		28.4		10000–15000	4322 020 90810 4322 020 90850
14 × 9 × 5	3E2 3H1 4C6	3.55	28.5	0.445	> 5000 1) > 100	4322 020 36680 4322 020 36620 4322 020 91020
23 × 14 × 7	3E2 3H1 4C6	5.70	18.1	1.79	> 5000 1) > 100	4322 020 36690 4322 020 36630 4322 020 91070
29 × 19 × 7.5	3E1	7.50	20.1	2.58	2700 ± 20 %	4322 020 36550
36 × 23 × 10	3E1	9.20	14.2	5.60	2700 ± 20 %	4322 020 36560
36 × 23 × 15	3E1 4C6	9.20	9.42	8.50	2700 ± 20 % > 100	4322 020 36570 4322 020 91090

1) μ_{tor} is indicated by the colour of the circumference of the core. see table below,

<i>group</i>	<i>μ_{tor}</i>	<i>colour</i>	<i>group</i>	<i>μ_{tor}</i>	<i>colour</i>
2	2140–2360	red	6	2900–3210	blue
3	2300–2540	orange	7	3150–3480	violet
4	2480–2740	yellow	8	3420–3780	grey
5	2680–2960	green	9	3720–4110	white

The sorting into μ groups is done merely for the convenience of the user. The toroids are not available per separate group.

PIEZOXIDE

Piezoxide materials are piezoelectric ceramic materials, suitable for almost any electro-mechanical or mechano-electrical energy conversion. Because of their ceramic nature elements in these materials can be preshaped. The material grades are PXE4, PXE5, PXE6, PXE7, PXE11 and PXE21.

		PXE4	PXE5
Mechanical data			
Specific mass		7.45×10^3	7.55×10^3
Curie temperature		265	285
Modulus of elasticity Y_{11}^E		0.77×10^{11}	0.65×10^{11}
	Y_{33}^E	0.75×10^{11}	0.53×10^{11}
	Y_{55}^E		0.26×10^{11}
Specific heat		420	420
Heat conductivity		1.2	1.2
Compressive strength		$> 6 \times 10^8$	$> 6 \times 10^8$
Electrical data			
Relative dielectric constants $\epsilon_{33}^T/\epsilon_0$		1750	1800
	$\epsilon_{11}^T/\epsilon_0$		1800
Volume resistivity ρ_{el} at 25°C		10^{11}	10^{12}
Time constant $\tau = RC = \rho_{el} \cdot \epsilon_{33}^T$		> 25	> 250
Dielectric dissipation factor $\tan \delta$		0.6×10^{-2}	2.0×10^{-2}
Electro-mechanical data			
Coupling coefficients	k_p	0.55	0.58
	k_{31}	0.32	0.33
	k_{33}	0.64	0.70
	k_{15}		0.66
Piezoelectric charge constants	d_{31}	-141×10^{-12}	-178×10^{-12}
	d_{33}	290×10^{-12}	390×10^{-12}
	d_{15}		515×10^{-12}
Piezoelectric voltage constants	g_{31}	-9.4×10^{-3}	-11.3×10^{-3}
	g_{33}	18.7×10^{-3}	24.4×10^{-3}
	g_{15}		32.5×10^{-3}
Quality factor	Q_M^E	500	80
Frequency constants	N_p	2200	2000
	N_1	1620	1460
	N_3	2050	1850
	N_5		930

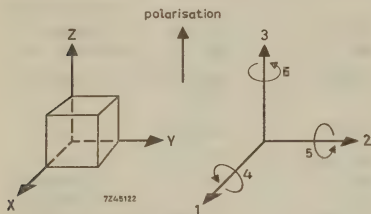
PXE6	PXE7	PXE11	PXE21	
7.7×10^3	7.6×10^3	4.5×10^3	7.7×10^3	kg/m ³
370	320	400	270	°C
0.98×10^{11}	0.82×10^{11}	1.2×10^{11}	0.66×10^{11}	N/m ²
	0.62×10^{11}	1.06×10^{11}	0.55×10^{11}	N/m ²
	0.28×10^{11}	0.41×10^{11}		N/m ²
420	420	420	420	J/kg.deg C
1.2	1.2	1.2	1.2	W/m.deg C
$> 6 \times 10^8$	$> 6 \times 10^8$	$> 6 \times 10^8$	$> 6 \times 10^8$	N/m ²
600	680	400	1750	
	1000	600		
10^{11}	10^{12}	10^{14}	10^{10}	Ωm
> 9	> 100	> 6000	> 2.5	min
1.0×10^{-2}	2.0×10^{-2}	2.5×10^{-2}	1.6×10^{-2}	
0.30	0.53	0.43	0.62	
0.18		0.25		
			0.73	
-42×10^{-12}	0.66	0.65		
	-84×10^{-12}	-44.5×10^{-12}		C/N
			370	C/N
-8.0×10^{-3}	350×10^{-12}	235×10^{-12}		C/N
	-14.0×10^{-3}	-11.2×10^{-3}		Vm/N
			24.0×10^{-3}	Vm/N
	44.2×10^{-3}	44.0×10^{-3}		Vm/N
1000	80	270	80	
2460	2250	3600	2000	Hz.m
	1640	2650	1390	Hz.m
			1400	Hz.m
	970	1500		Hz.m

PIEZOXIDE

Key to subscripts

For polarised ceramic materials the direction of positive polarisation is usually taken to be that of the Z-axis of a right-hand orthogonal crystallographic axial set X, Y, Z . Since these materials have polar symmetry the senses of X and Y chosen in an element are unimportant and planes parallel to the Z -axis are reflection planes.

If the directions of X, Y and Z are represented as 1, 2 and 3 respectively, and the shear directions to these axes as 4, 5 and 6 respectively then the various related parameters may be written with subscripts referred to these.



- 4 = shear in 23-plane
- 5 = shear in 31-plane
- 6 = shear in 12-plane

Axial notation

Piezoelectric constants : The first subscript refers to the direction of the electric field, the second subscript refers to the direction of the strain. (k_p is the planar coupling coefficient.)

Elasticity constants : The first subscript refers to the direction of the strain, the second subscript refers to the direction of the stress.

Dielectric constants : The first subscript refers to the direction of the dielectric displacement, the second subscript refers to the direction of the electric field.

Frequency constants : The subscript refers to the direction of resonance vibration.

Types of PXE elements

Discs and cylinders

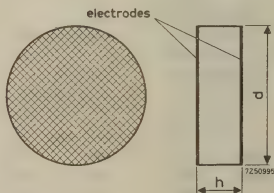
Direction of polarisation : axial

Standard tolerance on the diameter (d): $\pm 2.5\%$

Standard tolerance on the height (h)

for $h \geq 0.5$ mm: ± 0.1 mm

for $h < 0.5$ mm: ± 0.05 mm



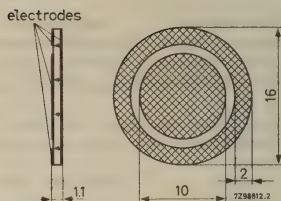
<i>dimensions (mm)</i> <i>d × h</i>	<i>catalog number</i>		
	<i>PXE4</i>	<i>PXE5</i>	<i>PXE21</i>
3 × 0.5		8222 293 01100	
3 × 8		4322 020 05120	
5 × 0.2		8222 293 01130	
5 × 0.3		8222 293 01140	
5 × 0.5	8222 293 10330	8222 293 06060	
5 × 0.75		8222 293 06070	
5 × 1	8222 293 08580		
5 × 2	8222 293 08590	8222 293 08650	
5 × 8			4322 020 05090
6.35 × 2			8222 293 13250
6.35 × 16	4322 020 05060		4322 020 05070
10 × 0.2		8222 293 01270	
10 × 0.3		8222 293 01280	
10 × 0.5		8222 293 07670	
10 × 1	8222 293 06050	4322 020 02330	
10 × 2	8222 293 08600	8222 293 07680	
10 × 3		8222 293 07740	
10 × 5	8222 293 00890	8222 293 07750	
10 × 10	8222 293 08610	8222 293 07690	
10 × 20	8222 293 06030	8222 293 08660	
16 × 0.2		8222 293 01300	
16 × 0.3		8222 293 01310	
16 × 0.5		8222 293 04300	
16 × 1.1	8222 293 04110	4322 020 02250	
16 × 2		8222 293 06010	
16 × 3	8222 293 08630	4322 020 02300	
25.4 × 0.5		8222 293 01410	
25.4 × 1	8222 293 08640	8222 293 08680	
25.4 × 2	8222 293 07710	8222 293 06020	
25.4 × 6.35	4322 020 02440		
38.1 × 6.35	4322 020 05000		

PIEZOXIDE

Three-electrode disc

Direction of polarisation: indicated by arrows,
see figure (side of
full electrode negative)

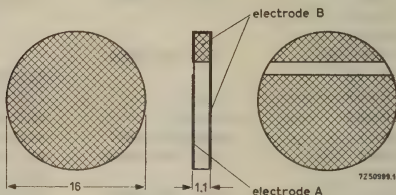
Material : PXE 5
Catalog number: 8222 293 07780



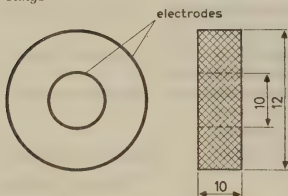
Feedback plates

Direction of polarisation: axial
Material : PXE 5

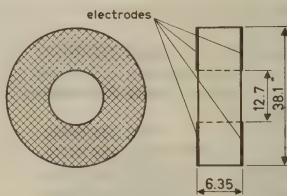
polarity of electrode A	catalog number
-	4322 020 02260
+	4322 020 02270



Rings



Direction of polarisation: radial
(outer electrode negative)
Material : PXE5
Catalog number : 8222 293 01870

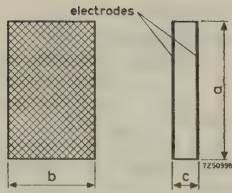


Direction of polarisation: axial
Material : PXE4
Catalog number : 4322 020 06000

Standard tolerance on the outer diameter: $\pm 2.5\%$
on the inner diameter: $\pm 2.5\%$
on the concentricity : 0.1 mm
on the height : ± 0.1 mm

Rectangular plates

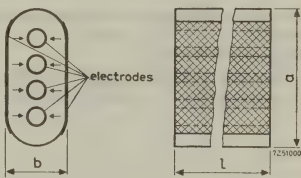
- Direction of polarisation** : parallel to dimension c
- Material** : PXE 5
- Standard tolerance on the length (a)** : ± 0.1 mm
- on the width (b)** : ± 0.1 mm
- on the thickness (c)** : ± 0.1 mm



dimensions (mm) $a \times b \times c$	catalog number
$12 \times 6 \times 0.5$	8222 293 02760
$12 \times 6 \times 1$	8222 293 02770
$16 \times 12 \times 1$	4322 020 02310

Multimorph strips

- Direction of polarisation** : indicated by arrows, see figure (outer electrodes negative)
- Material** : PXE 5



dimensions (mm) $a \times b \times l$	catalog number
$1.6 \times 0.67 \times 9.6$	4322 020 04760
$1.6 \times 0.67 \times 12.7$	4322 020 02480
$1.6 \times 0.67 \times 15.5$	4322 020 02490
$1.6 \times 0.67 \times 70$	8222 293 02940

Direction of polarisation: opposite to direction given in the Fig. above (outer electrodes positive)

dimensions (mm) $a \times b \times l$	catalog number
$1.6 \times 0.67 \times 9.6$	4322 020 04750
$1.6 \times 0.67 \times 12.7$	4322 020 02460
$1.6 \times 0.67 \times 15.5$	4322 020 02470

PIEZOXIDE

Bimorph strips

Direction of
polarisation : indicated by arrows,
see figure (outer
electrodes negative)

Material : PXE 5

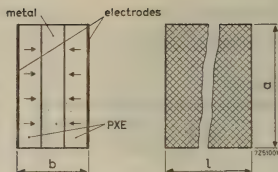
dimensions (mm) $a \times b \times l$	catalog number
--	----------------

$1.6 \times 0.50 \times 12.7$	4322 020 04370
-------------------------------	----------------

$1.6 \times 0.60 \times 15.0$	8222 293 09510
-------------------------------	----------------

$6.35 \times 0.50 \times 11.6$	8222 293 08010
--------------------------------	----------------

$8.0 \times 0.60 \times 8.0$	4322 020 04380
------------------------------	----------------



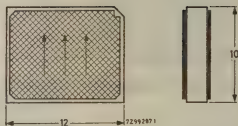
Delay-line transducer

Direction of polarisation : indicated by arrows, see figure

Material : PXE 7

Frequency of the thick-
ness shear vibration : approx. 4.1 MHz

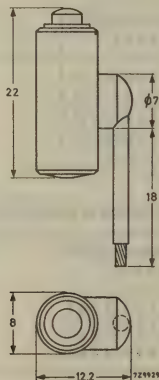
Catalog number : 8222 293 13330



Ignition unit

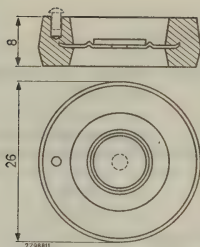
Material : PXE 21

Catalog number : 4322 020 08010



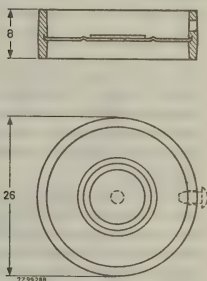
Flexure elements

Detector
 Material : PXE 5
 Resonance frequency : 6 ± 0.4 kHz
 Capacitance at 100 Hz : ≥ 4300 pF
 Catalog number : 4322 020 08760



Detector

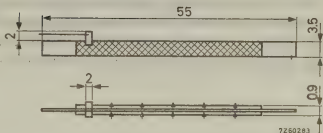
Material : PXE5
 Resonance frequency : 2.85 ± 0.35 kHz
 Capacitance at 100 Hz : ≥ 4300 pF
 Catalog number : 4322 020 08770



Drive element for low-power synchronous motors

Direction of polarisation: indicated by arrows,
 see figure

Material : PXE 4
 Catalog number : 8222 410 30050



PERMANENT MAGNET MATERIALS

Introduction

Permanent magnets – either isotropic* or anisotropic* – can be classified as being basically either
metallic alloy
ceramic material or
plastic bonded ceramic material

The table shows the class to which each of our materials belongs.

	<i>metallic alloy</i>	<i>ceramic material</i>	<i>plastic bonded ceramic material</i>
isotropic*	reco	ferroxdure	ferroxdure
anisotropic*	"Ticonal"***	ferroxdure	ferroxdure

The most obvious differences between the groups are that the ferroxdure magnets are characterised by high values of coercivity and resistivity while "Ticonal" magnets possess higher values of remanent magnetism and energy product.

Ferroxdure is therefore most suitable for applications in which demagnetising influences (either from external sources or resulting from the use of short magnets) are large and also in high frequency applications.

"Ticonal" is particularly suitable for applications in which high values of magnetic energy are required from small volumes of magnetic material.

The isotropic materials in general are inferior in magnetic properties to the anisotropic ones but are particularly suitable for applications in which multipolar magnets are to be used or where less expensive magnets are necessary giving a reasonable performance.

The plastic bonded ferroxdure magnets combine the characteristic magnetic properties of isotropic ferroxdure (however on a lower level) with the mechanical properties of the plastic material used. These magnets open a new field of applications, especially where the price is of prime importance. Each of the permanent magnet materials is manufactured in a variety of grades possessing different properties that result from differences in composition and treatment.

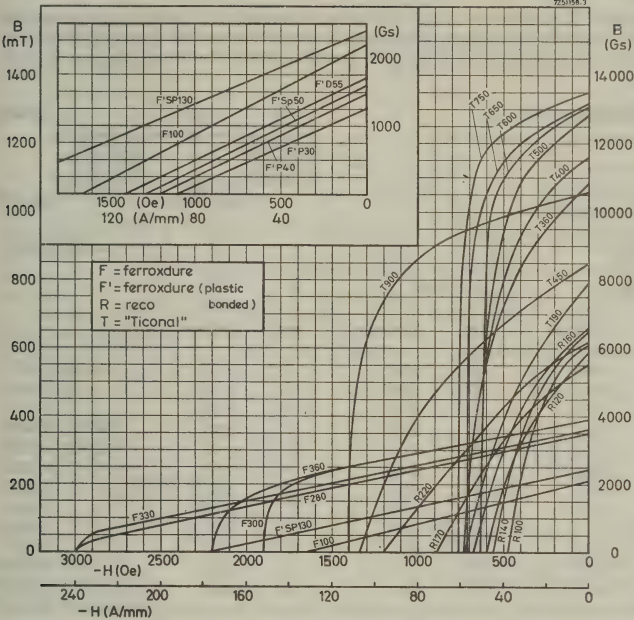
The grades are distinguished by the addition of letters and numbers to the name of the material.

The numbers are approximately relative to the nominal energy product of the grade.

* Isotropic materials can be magnetised equally well in any direction. Anisotropic materials have optimal magnetic properties in one direction only.

** "Ticonal" is a registered trade name.

Demagnetisation curves



Conversion table for S.I. units (Giorgi units)

1000 Gs	= 100 mT (= 0.1 Wb/m ²)
1 Oe	= $\frac{10^3}{4\pi}$ A/m \approx 0.08 A/mm
1 MGs · Oe	= 8 kJ/m ³
1 Mx	= 0.01 μ Wb
μ_0	= $4\pi \cdot 10^{-7}$ H/m = 1 Gs/Oe

PERMANENT MAGNET MATERIALS

PREFERRED TYPES

A "selection" of our preferred types is given below. A complete list of preferred types, comprising the shapes and sizes of permanent magnets from existing moulds and dies, is available on request. We offer every assistance in the primary and secondary aspects of permanent magnets and their systems.

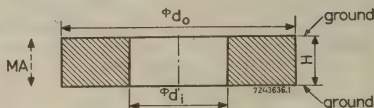
Anisotropic ferroxdure

Ring magnets for loudspeakers etc.

Material: Fxd 300R

Magnetic axis: axial

Supplied unmagnetised



dimensions

catalog number

outer diam.		inner diam.		H		
mm	tolerance	mm	tolerance	mm	tolerance	
36	± 0.8	18	± 0.5	8	± 0.1	4322 020 60070
45	± 1	22	± 0.6	9	± 0.1	60110
51	± 1.2	24	± 0.6	9	± 0.1	60150
53	± 1.2	24	± 0.5	11	± 0.1	4304 071 80620
55	± 1.2	24	± 0.6	12	± 0.1	4322 020 60170
60	± 1.5	24	± 0.6	13	± 0.1	60200
72	± 1.5	32	± 0.7	15	± 0.1	60240
90	± 1.8	36	± 0.9	17	± 0.15	60280
102	± 3	51	± 1.5	10	± 0.15	60300
121	± 3.6	57	± 1.7	12	± 0.2	60320
134	± 4	57	± 1.7	14	± 0.2	60330
184	± 5.5	73	± 2.2	18.5	± 0.2	60350

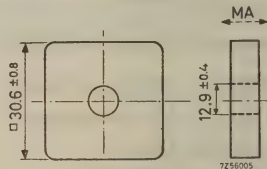
Square magnet for loudspeakers

Material: Fxd 300R

Magnetic axis: axial

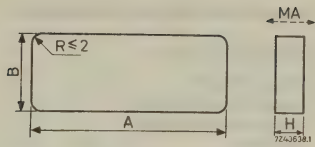
Supplied: unmagnetised

Catalog number: 4322 020 63010



Blocks

Material: see below
Magnetic axis: $\perp A \times B$
Supplied: magnetised

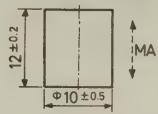


dimensions						material	catalog number
A		B		H			
mm	tolerance	mm	tolerance	mm	tolerance		
15	±0.3	9	±0.5	5	±0.25	280K	3122 104 92700
50	±1.3	19	±0.5	4.9	-0.25	280K	62100 ¹⁾
50	±1.3	19	±0.5	6.1	±0.1	280K	62120 ¹⁾
131	±3	51	±1.5	17.5	±0.2	330K	62140 ¹⁾

¹⁾ Supplied unmagnetised.

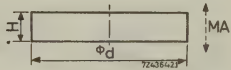
Solid cylinders

Material: Fxd 280
Magnetic axis: axial
Supplied: magnetised
Catalog number: 4322 020 61010



Discs

Material: see below
Magnetic axis: axial
Supplied: unmagnetised



dimensions				material	catalog number
d		H			
mm	tolerance	mm	tolerance		
5.5	±0.05	1.8	±0.03	330K	4322 020 62590
12	±0.3	6	±0.25	300R	62540 ¹⁾
40.6	±1	9	±0.1	280K	62550

¹⁾ Supplied magnetised.

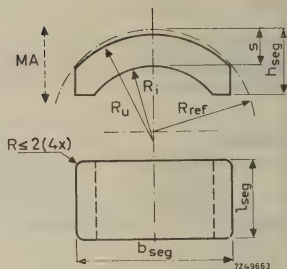
PERMANENT MAGNET MATERIALS

Segments for d.c. motors

Material: Fxd 330

Magnetic axis: diametrical

Supplied: unmagnetised

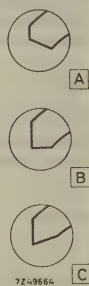
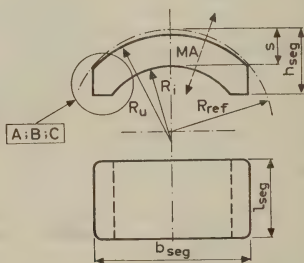


R_i	R_u	s	h_{seg}		b_{seg}		l_{seg}		catalog number
mm	tol.	mm	mm	tol.	mm	tol.	mm	tol.	
≥ 8.315	≥ 12.025	≤ 3.66	8	± 0.6	18	± 0.5	15	± 1	4322 020 61850
≥ 20.3	≥ 29	≤ 8.8	16	± 0.3	42	± 1	41	± 1	4311 021 30660

Material: Fxd 280

Magnetic axis: radial

Supplied: unmagnetised



R_i	R_u	s	h_{seg}		b_{seg}		l_{seg}		catalog number	Fig.
mm	mm	mm	mm	tol.	mm	tol.	mm	tol.		
≥ 28.58	≥ 35.13	≤ 6.55	25.5	± 0.6	62.4	$+0.4$	26.7	± 0.75	4322 020 61510	A
≥ 28.50	≥ 35.55	≤ 7.35	21.4	-1.2	60.3	$+3.0$	49.4	± 1	61820	C
≥ 29.03	≥ 36.02	≤ 7.49	21.79	± 0.38	62.7	$+3.0$	27.88	± 1.25	61590	B

Isotropic ferroxdure

Discs and bars

Material: Fxd 100

a) axially magnetised

dimensions catalog number Fig.

diam. d		H			
mm	tolerance	mm	tolerance		
3	± 0.2	7.5	± 0.25	4312 020 60130	1
6	± 0.3	40	± 0.6	60170	1
4	± 0.2	3.5	± 0.2	65950	2
25	± 0.5	5	± 0.4	65870	2



Fig. 1

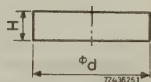
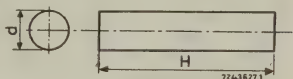


Fig. 2

b) diametrically magnetised rods

dimensions catalog number

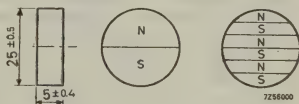
diam. d		H			
mm	tolerance	mm	tolerance		
4	± 0.1	10	± 0.2	4312 020 60040	
6	-0.05	12	± 0.2	3122 104 94330	



c) laterally magnetised disc

6 poles on 1 face

Catalog number 4312 020 65780

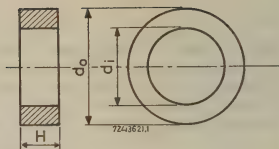


7256000

PERMANENT MAGNET MATERIALS

Rings

Material: Fxd 100



a) diametrically magnetised

dimensions

catalog number

outer diam.		square hole		H		
mm	tolerance	mm	tolerance	mm	tolerance	
12.25	± 0.25	3.2	± 0.5	10	± 0.5	4312 020 62110
12	$+0.5$	3.2	± 0.5	12	± 0.5	62120

b) axially magnetised

dimensions

catalog number

outer diam.		inner diam.		H		
mm	tolerance	mm	tolerance	mm	tolerance	
14	± 0.5	1.5	± 0.5	5	± 0.5	4312 020 62180
29.9	-0.05	10	± 0.3	5	-0.1	62270 ¹⁾

¹⁾ 4p axially magnetised.

c) radially magnetised

dimensions

magnetisation

catalog number

outer diam.		inner diam.		H			
mm	tolerance	mm	tolerance	mm	tolerance		
12	± 0.5	4.05	± 0.3	7	± 0.5	S pole on circ.	4312 020 63150
27	± 0.7	20	± 0.6	3.5	± 0.5	N pole on circ.	62340

d) laterally magnetised

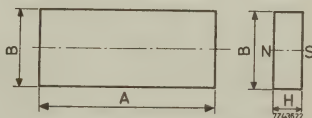
dimensions						magnetisation	catalog number
outer diam.		inner diam.		H			
mm	tol.	mm	tol.	mm	tol.		
21	± 0.3	10	± 0.5	24	+0.7	8 poles on outer diam.	4312 020 63160
37	± 0.8	25	± 0.5	3.5	-0.5	4 poles on one surface	62400

e) rings for couplings (laterally magnetised)

dimensions						magnetisation	catalog number
outer diam.		inner diam.		H			
mm	tol.	mm	tol.	mm	tol.		
55	± 0.05	15	± 0.5	13	± 0.1	12 poles on outer Ø	4312 020 62430
78	± 1.5	58	± 0.05	13	± 0.1	12 poles on inner Ø	62420

Blocks

Material: Fxd 100
magnetised $\perp A \times B$



7243622

dimensions						catalog number
A		B		H		
mm	tolerance	mm	tolerance	mm	tolerance	
50	± 1.25	43	± 1.1	11	± 0.28	4312 020 66960
10	± 0.5	5	± 0.5	3	± 0.5	66760

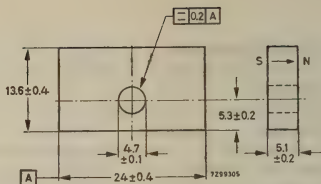
PERMANENT MAGNET MATERIALS

Block with holes

Material: Fxd 100

magnetised $\perp A \times B$

Catalog number 4312 020 66710



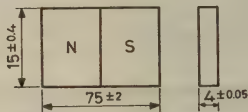
Block

Material: Fxd 100

laterally magnetised

8 poles on 75×15

Catalog number 4312 020 66860

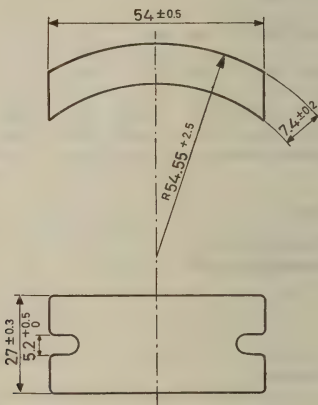


Segment

Material: Fxd 100

not magnetised

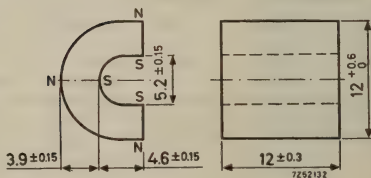
Catalog number 4312 020 61500



Special parts for colour TV sets

Material: see below

Supplied: magnetised



article	dimensions in mm		material	magnetic axis	catalog number
	diameter d	H			
Disc	20 ± 0.35	5 ± 0.3	Fxd100	diametric	3122 104 90620
Bar	5-0.2	10 ± 0.2	Fxd100	diametric	92850
Segment	see drawing		P40	radial	93770

Isotropic plastic-bonded ferroxdure

Material: see below Supplied: magnetised

article	dimensions	material	magnetic axis	catalog number
Strip	$(9 \pm 0.3) \times (3 \pm 0.1)$	P40	2 poles lateral	4312 020 70020
Ring	$\varnothing(28 \pm 0.1) \times (20.5 \pm 0.1) \times (16.5 \pm 0.25)$	D55	2 poles on int. circ.	4312 020 72040
Block	$(10.6 - 0.6) \times (10.6 - 0.6) \times (3 \pm 0.15)$	P30	diametrical	3122 104 93540
Bar	$\varnothing(5 \pm 0.2) \times (40 - 1)$	P40	axial	3122 104 90360
Rings with 1 to 3 lobes for T.V. deflection units		SP10 or P40	2 poles on int. circ.	

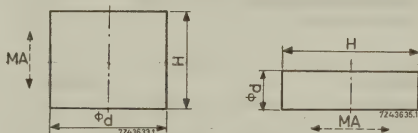
Anisotropic "Ticonal"

Solid cylinders

Material: see below

Direction of magnetisation: axial

Supplied: unmagnetised



dimensions				material	catalog number
d		H			
mm	tolerance	mm	tolerance		
12.9	-0.3	10	-0.05	'Ticonal' 750	4322 059 75060
15.8	-0.1	13	± 0.1	'Ticonal' 750	75030
18	-0.4	12	-0.1	'Ticonal' 600	60000
19.4	± 0.3	9.4	± 0.1	'Ticonal' 750	75080
21	± 0.5	16	± 0.05	'Ticonal' 600	60010
28.3	± 0.4	19.45	± 0.05	'Ticonal' 600	61060
34.7	± 0.4	19	± 0.05	'Ticonal' 600	61080

Cylindrical slugs in "Ticonal" 750 can be supplied in any length. Standard diameters are between 12 and 22 mm; others available if required

PERMANENT MAGNET MATERIALS

Rods

Material: 'Ticonal' 500

Direction of magnetisation: axial

dimensions				condition	catalog number
<i>d</i>		<i>H</i>			
mm	tolerance	mm	tolerance		
4	± 0.2	6	± 0.2	unmagnetised	4322 059 50070 ¹⁾
5.5	-1	25	± 0.5	magnetised	50100 ¹⁾
8.1	-1	65	± 0.5	magnetised	50110 ¹⁾

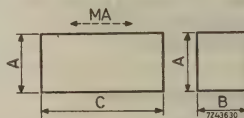
¹⁾ Rods in these and other small diameters can be supplied in any length between 6 and 100 mm.

Blocks

Material: see below

Direction of magnetization: \perp face $A \times B$

Version: see below



dimensions						material	version	catalog number
<i>A</i>		<i>B</i>		<i>C</i>				
mm	tol.	mm	tol.	mm	tol.			
2	± 0.05	2.6	± 0.05	2.25	-0.03	'Ticonal' 900	unmagnetised	4322 059 90000
4	± 0.05	4	± 0.05	5	± 0.02	'Ticonal' 900	unmagnetised	90010
27	-1	20	± 0.5	17	± 0.05	'Ticonal' 450	unmagnetised	45130
100	± 1	12	± 0.05	29.1	± 0.05	'Ticonal' 500	unmagnetised	50130 ¹⁾
10.5	± 0.2	17	± 0.3	40	± 0.05	'Ticonal' 500	unmagnetised	50170

¹⁾ with two mounting holes.

**TYPE NUMBER INDEX OF
TUBES, SEMICONDUCTORS,
INTEGRATED CIRCUITS,
COMPONENTS AND MATERIALS**

TYPE NUMBER INDEX OF TUBES, SEMICONDUCTORS
AND INTEGRATED CIRCUITS

A28-14W	A68	AC172	B51	ADY26	B87
A31-20W	A68	AC187	B52	ADZ11	B87
A31-120W	A68	AC187/01	B52	ADZ12	B87
A44-120W	A68	AC188	B52	AF121	B69
A47-14W	A69	AC188/01	B52	AF124	B69
A47-26W	A69	AD0160/..	C248	AF125	B69
A50-120W	A69	AD149	B86	AF126	B69
A56-120X	A70	AD161	B86	AF127	B70
A56-140X	A70	AD162	B86	AF139	B70
A59-11W	A69	AD1056/..	C248	AF239	B70
A59-15W	A69	AD1065/..	C249	AF239S	B70
A59-16W	A69	AD1256/..	C248	AF240	B71
A59-23W	A69	AD1265/..	C249	AF267	B71
A61-120W	A69	AD2070/..	C244	AFY16	B71
A63-120X	A70	AD2071/..	C248	AFY19	B97
A65-11W	A69	AD3070/..	C244	AFY40	B71
A66-120X	A70	AD3370/..	C244	AFZ12	B72
A66-140X	A70	AD3590/..	C246	AGR9950	A150
AA119	B2	AD3880/..	C246	AP2151/..	C240
AAV11	B2	AD3890/..	C246	AP2152/..	C240
AAV21	B2	AD4070/..	C244	AP2153/..	C241
AAV30	B2	AD4080/..	C244	APY16	
AAV32	B2	AD4090/..	C245	to	A187
AAZ13	B3	AD4680/..	C246	APY19	
AAZ15	B3	AD4690/..	C247	APY21	
AAZ17	B3	AD5060/..	C248	to	A187
AAZ18	B3	AD5080/..	C245	APY24	
AC125	B50	AD5780/..	C247	APY41	
AC126	B50	AD6980/..	C247	to	A187
AC127	B50	AD7061/..	C249	APY46	
AC127/01	B50	AD7065/..	C248	APY56	A187
AC128	B51	AD7080/..	C245	APY57	A187
AC128/01	B51	AD7091/..	C245	ASY26	B105
AC132	B51	AD8065/..	C248	ASY27	B105
AC132/01	B51	AD8080/..	C245	ASY28	B105

ASY29	B106	AT2036/10	C263	B330 . . series	A149
ASY31	B106	AT2036/37	C264	B410 . . series	A149
ASY32	B106	AT2051/00	C272	B419 . . series	A149
ASY73	B106	AT2053/02	C273	BA100	B3
ASY74	B107	AT2100/04	C274	BA102	B15
ASY75	B107	AT2101/02	C275	BA114	B3
ASY76	B107	AT4040/ . .	C276	BA145	B4
ASY77	B107	AT4041/07	C280	BA148	B4
ASY80	B107	AT4041/08	C281	BA182	B4
ASZ15	B87	AT4041/14	C282	BA216	B4
ASZ16	B88	AT4041/15	C282	BA217	B4
ASZ17	B88	AT4042/02	C283	BA218	B5
ASZ18	B88	AT4042/12	C284	BA219	B5
ASZ20	B108	AT4043/86	C285	BA220	B5
ASZ21	B108	AT4045/07	C285	BA221	B5
AT1025/05	C266	AT4045/08	C286	BA222	B5
AT1025/08	C266	AT4046/07	C285	BAV10	B5
AT1027/07	C267	AT4046/08	C286	BAV40	B6
AT1027/09	C268	AT4050/11	C286	BAV41	B6
AT1029/07	C268	AT7672/90	C252	BAV42	B6
AT1029/09	C268	AUY10	B88	BAV43	B8
AT1040	C262	AVHC41	A146	BAV45	B8
AT1060/01	C269	AVHC201	A146	BAW56	B136
AT1062/01	C270	AW43-88	A70	BAW62	B8
AT1065/00	C271	AW47-91	A71	BAW99	B113
AT1065/01	C271	AW53-80Z	A71	BAX12	B8
AT1102/01	C291	AW53-88	A71	BAX13	B9
AT1103	C292	AW59-90	A71	BAX15	B9
AT1113/01	C293	AW59-91	A71	BAX16	B9
AT1113/03	C294	AW61-88	A72	BAX17	B9
AT1115	C294	AYY10-120	B29	BAX18	B9
AT1116	C295	AZ41	A2	BAY66	B15
AT1117	C296	B310 . . series	A149	BAY96	B15
AT1119	C296	B312 . . series	A149	BB60	C15
AT1132/01	C297	B318 . . series	A149	BB104B	B15

TYPE NUMBER INDEX OF TUBES, SEMICONDUCTORS
AND INTEGRATED CIRCUITS

BB104G	B15	BCA10	C9	BCY70	B65
12-BB105A	B16	BCW29	B136	BCY71	B65
12-BB105B	B16	BCW30	B136	BCY72	B66
12-BB105G	B16	BCW31	B137	BCY87	B140
12-BB106	B16	BCW32	B137	BCY88	B140
BB110B	B16	BCW33	B137	BCY89	B141
BB117	B17	BCW46	B60	BCZ10	B66
BC107	B53	BCW47	B60	BCZ11	B66
BC108	B53	BCW48	B60	BCZ12	B66
BC109	B53	BCW49	B61	BD115	B89
BC146	B54	BCW56	B61	BD124	B89
BC147	B54	BCW57	B61	BD131	B89
BC148	B54	BCW58	B61	BD132	B90
BC149	B54	BCW59	B61	BD133	B90
BC157	B54	BCW69	B137	BD135	B90
BC158	B55	BCW70	B138	BD136	B90
BC159	B55	BCW71	B138	BD137	B91
BC177	B55	BCW72	B138	BD138	B91
BC178	B55	BCY10	B62	BD139	B91
BC179	B56	BCY11	B62	BD140	B91
BC200	B56	BCY12	B62	BD144	B104
BC237	B57	BCY30	B62	BD181	B92
BC238	B57	BCY31	B62	BD182	B92
BC239	B57	BCY32	B63	BD183	B92
BC307	B57	BCY33	B63	BDY10	B93
BC308	B58	BCY34	B63	BDY11	B93
BC309	B58	BCY38	B63	BDY20	B93
BC327	B58	BCY39	B63	BDY38	B93
BC328	B59	BCY40	B63	BDY60	B94
BC337	B59	BCY54	B64	BDY61	B94
BC338	B59	BCY55	B140	BDY90	B94
BC407	B59	BCY56	B64	BDY91	B94
BC408	B59	BCY57	B64	BDY92	B94
BC409	B60	BCY58	B65	BEY801	B73
BCA1	C3	BCY59	B65	BF115	B72

BF167	B72	BFS21A	B128	BLY87A	B100
BF173	B73	BFS22A	B97	BLY88A	B100
BF177	B73	BFS23A	B97	BLY89A	B100
BF178	B73	BFS28	B129	BLY90	B100
BF179	B73	BFS92	B80	BLY91A	B101
BF180	B73	BFS93	B80	BLY92A	B101
BF181	B74	BFS94	B80	BLY93	B101
BF182	B74	BFS95	B80	BLY94	B101
BF183	B74	BFW10	B130		
BF184	B74	BFW11	B130	BPX10	
				to	A188
BF185	B75	BFW12	B130	BPX14	
BF186	B75	BFW13	B130	BPX25	A135
BF194	B75	BFW16A	B81	BPX29	A135
BF195	B75	BFW17A	B81	BPX40	A135
BF196	B76	BFW30	B81	BPX41	A135
BF197	B76	BFW45	B104	BPX42	A135
BF198	B76	BFW61	B131	BPX56	A188
BF199	B77	BFW92	B82	BPX57	A188
BF200	B77	BFX34	B109	BPX71	A135
BF254	B77	BFX44	B82	BPY10	A135
BF255	B77	BFX89	B82	BPY20	
BF334	B78	BFY44	B97	to	A188
BF335	B78	BFY50	B83	BPY24	
BF336	B78	BFY51	B83	BPY51	
BF337	B78	BFY52	B83	to	A189
				BPY57	
BF338	B78	BFY55	B83		
BFR29	B128	BFY70	B98	BPY58	A189
BFR63	B79	BFY90	B84	BPY59	A136
BFR64	B79	BLX13	B98	BPY68	A136
BFR65	B79	BLX14	B98	BPY69	A136
				BPY75-300	A191
BFS17	B138	BLX69	B98	BPY76	A135
BFS18	B139	BLY14	B99	BPY77	A135
BFS19	B139	BLY17	B99	BPY81	
BFS20	B139	BLY83	B99	to	A190
BFS21	B128	BLY84	B99	BPY87	

TYPE NUMBER INDEX OF TUBES, SEMICONDUCTORS AND INTEGRATED CIRCUITS

BPY88	A190	BSX61	B115	BTY99 series	B45
BPY89	A190	BSX82	B115	BU105	B104
BR100	B36	BSY10	B115	BU108	B104
BRY39	B36	BSY11	B115	BXY27	B17
BRY39(SCS)	B141	BSY38	B115	BXY28	B17
BRY39(PUT)	P142	BSY39	B116	BXY29	B17
BSS27	B109	BT100A series	B36	BXY32	B17
BSS28	B109	BT101 series	B37	BY118	B29
BSS29	B110	BT102 series	B37	BY126	B29
BSV52	B139	BTW23 series	B38	BY127	B29
BSV64	B110	BTW24 series	B38	BY164	B46
BSV68	B110	BTW30 series	B38	BY176	B29
BSV78	B131	BTW31 series	B39	BY179	B46
BSV79	B131	BTW47 series	B39	BY184	B29
BSV80	B131	BTW92 series	B39	BY185	B30
BSV81	B132	BTX18 series	B40	BY187	B30
BSV86	B110	BTX35 series	B40	BYX10	B30
BSV87	B111	BTX36 series	B40	BYX13 series	B30
BSV88	B111	BTX37 series	B40	BYX22 series	B30
BSV96	B111	BTX38 series	B40	BYX23 series	B30
BSV97	B111	BTX41 series	B41	BYX25 series	B30
BSV98	B111	BTX47 series	B41	BYX27 series	B30
BSW41	B112	BTX48 series	B41	BYX29 series	B31
BSW66	B112	BTX49 series	B42	BYX30 series	B31
BSW67	B112	BTX50 series	B42	BYX32 series	B31
BSW68	B112	BTX68 series	B42	BYX33 series	B32
BSW69	B112	BTX81 series	B42	BYX34 series	B32
BSX12	B113	BTX82 series	B43	BYX35	B32
BSX12A	B113	BTX92 series	B43	BYX36 series	B32
BSX19	B113	BTX94 series	B44	BYX38 series	B33
BSX20	B114	BTX95 series	B44	BYX39 series	B33
BSX21	B114	BTY79 series	B44	BYX40 series	B33
BSX44	B114	BTY87 series	B45	BYX42 series	B33
BSX59	B114	BTY91 series	B45	BYX45 series	B33
BSX60	B115	BTY95 series	B45	BYX46 series	B33

BYX48 series	B34	CR25	C172	D14-122 ..	A77
BYX50 series	B34	CR37	C172	D14-123 ..	A77
BYX51 series	B34	CR52	C172	D14-160GH/09	A77
BYX52 series	B34	CR68	C172	DC70	A50
BYX56 series	B35	CR93	C172	DCA3	C4
BYX59 series	B35	CRY1	A191	DCA10	C8
BZX29 series	B19	CRY2	A191	DCD50	C13
BZX48	B20	CRY3	A191	DCG1/250	A150
BZX49	B20	CRY4	A191	DCG4/1000ED	A150
BZX50	B20	CRY101	A191	DCG4/1000G	A150
BZX61 series	B20	CRY103	A191	DCG4/5000	A151
BZX70 series	B21	CRY104	A191	DCG5/5000EG	A151
BZX75 series	B21	CSPD	C23	DCG5/5000GB	A151
BZX79 series	B22	D3a	A50	DCG5/5000GS	A151
		D7-190 ..	A73	DCG6/18	A151
BZY56					
to	B22	D10-11 ..	A73	DCG6/18GB	A151
BZY63		D10-12 ..	A73	DCG6/6000	A152
BZY78	B23	D10-160 ..	A73	DCG7/100	A152
BZY88 series	B23	D10-161 ..	A73	DCG7/100B	A152
BZY91 series	B24	D10-170GH	A73	DCG9/20	A152
BZY93 series	B24	D10-200GH/07	A74	DCG12/30	A153
BZY94 series	B25	D13-15 ..	A74	DCX4/1000	A153
BZY95 series	B25	D13-16 ..	A74	DCX4/5000	A153
BZY96 series	B26	D13-16 .. /01	A74	DF61N	A51
		D13-19 ..	A74	DF66	A51
BZZ14					
to	B26	D13-21 ..	A75	DF67	A51
BZZ29		D13-26 ..	A75	DG7-5	A77
C3J	A161	D13-26 .. /01	A75	DG7-6	A77
C3JA	A161	D13-27GH	A75	DG7-31	A78
C3m	A50	D13-450GH/01	A76	DG7-32	A78
CM20	C36	D13-480 ..	A76	DG7-36	A78
CP16 series	C196	D13-481 ..	A76	DG10-5	A79
CP23 series	C199	D13-500GH/01	A76	DG10-6	A79
CQY11B	A137	D14-120 ..	A76	DG10-74	A79
CR16	C172	D14-121 ..	A77	DG13-2	A79

TYPE NUMBER INDEX OF TUBES, SEMICONDUCTORS
AND INTEGRATED CIRCUITS

DG13-32	A79	DY51	A3	E182CC	A57
DG13-34	A80	DY86	A4	E186F	A57
DH3-91	A77	DY87	A4	E188CC	A58
DH7-11	A78	DY802	A4	E235L	A58
DH7-78	A78	DZD40	C10	E236L	A58
DH10-78	A79	E1T	A196	E280F	A58
DL20	C287	E10-12 ..	A80	E282F	A59
DL50	C288	E10-130 ..	A80	E283CC	A59
DL51	C288	E13/7/3	C368	E288CC	A59
DL53	C289	E20/10/5	C368	E810F	A59
DL55	C290	E30/15/7	C368	EA52	A129
DL64	A51	E42/21/15	C368	EA53	A129
DL66	A51	E55/28/21	C368	EA76	A52
DL68	A52	E55L	A52	EAA91	A4
DL96	A2	E65/32/13	C368	EABC80	A5
DM70	A2	E80CC	A52	EA41	A5
DM71	A3	E80CF	A53	EA42	A5
DM160	A52	E80F	A53	EB41	A5
DN7-11	A78	E80L	A53	EBC3	A6
DN7-36	A78	E80T	A196	EBC41	A6
DN7-78	A78	E81L	A53	EBC81	A6
DN10-78	A79	E82CC	A53	EBF2	A6
DOA40	C10	E83CC	A54	EBF80	A7
DOA42	C10	E83F	A54	EBF83	A7
DOA61	C16	E84L	A54	EBF89	A7
DP7-5	A77	E86C	A55	EBL1	A7
DP7-6	A77	E88C	A55	EBL21	A8
DP7-11	A78	E88CC	A55	EC55	A129
DP7-78	A78	E90CC	A55	EC80	A59
DP10-6	A79	E90F	A55	EC81	A60
DP10-74	A79	E92CC	A56	EC86	A8
DP10-78	A79	E99F	A56	EC88	A8
DP13-2	A79	E130L	A56	EC90	A60
DP13-34	A80	E180CC	A57	EC91	A60
DX206	A125	E180F	A57	EC92	A8

EC97	A8	ECL85	A15	EL82	A22
EC157	A129	ECL86	A15	EL83	A23
EC158	A130	ECL805	A15	EL84	A23
EC900	A8	ED500	A16	EL86	A23
EC1000	A60	EF6	A16	EL91	A23
EC8010	A61	EF9	A16	EL95	A24
ECC40	A9	EF22	A16	EL360	A62
ECC81	A9	EF40	A16	EL500	A24
ECC82	A9	EF41	A17	EL503	A24
ECC83	A9	EF42	A17	EL504	A24
ECC84	A9	EF43	A17	EL508	A25
ECC85	A10	EF50	A61	EL509	A25
ECC86	A10	EF80	A17	EL519	A25
ECC88	A10	EF83	A17	EL802	A25
ECC186	A61	EF85	A18	ELC1004	C254
ECC189	A10	EF86	A18	ELC1024	C256
ECC2000	A61	EF89	A18	ELC1034	C257
ECF80	A10	EF91	A18	ELC1054	C258
ECF86	A10	EF92	A19	ELC2000S	C259
ECF200	A10	EF95	A19	EM80	A25
ECF201	A10	EF97	A19	EM81	A25
ECF801	A10	EF98	A19	EM84	A25
ECF802	A11	EF183	A19	EM87	A26
ECH3	A11	EF184	A20	EPD	C21
ECH4	A11	EFF51	A62	EPD60	C22
ECH21	A11	EFL200	A20	EY51	A26
ECH41	A12	EFP60	A62	EY81	A26
ECH42	A12	EH90	A20	EY82	A26
ECH81	A13	EL3N	A20	EY86	A26
ECH83	A13	EL34	A20	EY87	A26
ECH84	A14	EL36	A21	EY88	A26
ECH200	A14	EL41	A21	EY500A	A27
ECL80	A14	EL42	A22	EZ40	A27
ECL82	A15	EL60	A22	EZ41	A27
ECL84	A15	EL81	A22	EZ80	A27

**TYPE NUMBER INDEX OF TUBES, SEMICONDUCTORS
AND INTEGRATED CIRCUITS**

EZ81	A27	FCJ131	B150	FDR121Z ...	B224
F044	C78	FCJ141	B150	FDR131Z1	B224
F045	C87	FCJ191	B150	FF3	C2
F046	C83	FCJ201	B150	FF4	C2
F047	C84	FCJ211	B150	FF10	C6
F048	C91	FCK111	B152	FF11	C6
F050	C85	FCL101	B152	FF12	C6
F051	C91	FCY101	B152	FF90	C17
F053	C86	FDH106	B156	FI-2	C45
F054	C80	FDH116	B162	FI-3	C45
F057	C89	FDH126	B166	FI-4	C45
F058	C82	FDH136	B170	FI-11	C45
F059	C79	FDH146	B174	FI-14	C45
FCH101	B146	FDH156	B178	FI-21	C46
FCH111	B146	FDJ106	B180	FI-23	C46
FCH121	B146	FDN106	B186	FI-41	C46
FCH131	B146	FDN116	B189	FI-41F	C46
FCH141	B146	FDN126	B190	FI-42	C46
FCH151	B146	FDN136	B191	FI-43	C47
FCH161	B146	FDN146	B194	FJH101/7430	B236
FCH171	B146	FDN156	B196	FJH111/7420	B236
FCH181	B146	FDN186	B198	FJH121/7410	B236
FCH191	B146	FDN206A	B200	FJH131/7400	B236
FCH201	B146	FDN206B	B200	FJH141/7440	B236
FCH211	B146	FDN216A	B202	FJH151/7450	B236
FCH221	B148	FDN216B	B202	FJH161/7451	B236
FCH231	B148	FDN506	B204	FJH171/7453	B238
FCH281	B148	FDN516	B204	FJH181/7454	B238
FCH291	B148	FDN536A	B208	FJH191/7480	B238
FCH301	B148	FDN536B	B208	FJH221/7402	B238
FCH311	B148	FDQ106	B210	FJH231/7401	B238
FCH321	B148	FDR116Z ...	B214	FJH241/7404	B238
FCJ101	B150	FDR116Z1	B214	FJH251/7405	B238
FCJ111	B150	FDR126Z ...	B220	FJH261/7442	B238
FCJ121	B150	FDR126Z1	B220	FJH291/7403	B238

FJJ101/7470	B240	JP9-18	A121	MR34	C177
FJJ111/7472	B240	JP9-75	A121	MR34C/D	C179
FJJ121/7473	B240	JPT9-01	A125	MR39	C180
FJJ131/7474	B240	K81A	A196	MR52	C175
FJJ141/7490	B240	KS9-20B	A126	MR54	C177
FJJ151/7491A	B240	KS9-20D	A126	MR54C/D	C179
FJJ181/7475	B240	KS9-40	A126	MR58	C180
FJJ191/7476	B242	KS9-40B	A126	MR81	C180
FJJ211/7493	B242	KS9-40D	A126	MU13-38	A89
FJJ251/7492	B242	LB6-25	A128	MW13-38	A89
FJJ261/74107	B242	LIP1	C24	MY13-38	A89
FJL101/7441	B242	LRD50	C13	NIC50	C11
FJY101/7460	B242	LSU60	C18	OA2	A167
G40-25	A149	M17-140W	A87	OA2WA	A167
G40-50	A149	M17-141W	A87	OA5	B9
GA11	C7	M21-11W	A87	OA7	B10
GDM11	C50	M21-12W	A87	OA9	B10
GDM12	C50	M24-100W	A87	OA47	B10
GDM21	C50	M28-12W	A88	OA70	B10
GY501	A27	M31-120W	A88	OA72	B10
GZ34	A28	M36-11W	A88	OA73	B10
H7	C372	M36-16W	A88	OA79	B11
H10	C372	M38-120W	A89	OA81	B11
H16	C372	MC13-16	A89	OA85	B11
H20	C372	MF0.5A	C19	OA90	B11
ID10	C8	MF2A	C19	OA91	B11
IVSR	C20	MG13-38	A89	OA92	B12
I42/7.5/15	C368	MID50	C11	OA95	B12
JP8-02B	A120	MK13-16	A89	OA200	B12
JP9-2.5D	A120	MPD	C23	OA202	B12
JP9-2.5E	A120	MR24	C177	OAP12	A136
JP9-7A	A120	MR24C/D	C179	OAZ200	
JP9-7D	A120	MR25	C175	to	B27
JP9-15	A120	MR30	C175	OAZ207	
JP9-15B	A120	MR31	C180	OB2	A167

TYPE NUMBER INDEX OF TUBES, SEMICONDUCTORS AND INTEGRATED CIRCUITS

OB2WA	A167	P3ACC../...	C32	PCL84	A33
OC139	B116	P3FCB../...	C32	PCL85	A34
OC140	B116	P3HCB../...	C31	PCL86	A34
OC141	B116	P3RB../...	C31	PCL805	A34
OCP70	A136	P9/5	C341	PD1	C3
OM200	B248	P11/7	C342	PD11	C7
ORP10	A137	P14/8	C344	PD500	A34
ORP13	A137	P18/11	C346	PD510	A34
ORP30N	A132	P22/13	C348	PDA1	C3
ORP50	A132	P26/16	C350	PDU50A	C13
ORP52	A132	P30/19	C352	PDU50B	C13
ORP60	A132	P36/22	C354	PE05/25	A103
ORP61	A132	P42/29	C354	PE06/40E	A103
ORP62	A133	PA1	C3	PE06/40N	A103
ORP63	A133	PA10	C8	PE06/40P	A103
ORP69	A133	PA60	C15	PE1/100	A103
ORP90	A133	PAA1	C3	PF86	A35
OS2	C3	PAA10	C8	PFL200	A35
OS11	C7	PABC80	A28	PG1	C5
OSB9110 series	B47	PC86	A28	PL2D21	A159
OSB9210 series	B47	PC88	A28	PL3C23A	A159
OSB9310	B48	PC92	A28	PL10	A159
OSB9410	B48	PC97	A29	PL36	A35
OSM9110 series	B47	PC900	A29	PL81	A35
OSM9210 series	B47	PCC85	A29	PL82	A36
OSM9310	B48	PCC88	A29	PL83	A36
OSM9410	B48	PCC189	A29	PL84	A36
OSS9110 series	B47	PCF80	A30	PL95	A36
OSS9210 series	B47	PCF86	A30	PL105	A159
OSS9310	B48	PCF200	A31	PL106	A159
OSS9410	B48	PCF201	A31	PL150	A159
PIACC../...	C32	PCF801	A32	PL255	A159
PIFCB../...	C32	PCF802	A32	PL260	A160
PIHCB../...	C31	PCH200	A33	PL500	A36
PIRB../...	C31	PCL82	A33	PL504	A37

PL505	A37	PS5410	A184	QEL1/150	A107
PL508	A37	PSM40	C11	QEL1/150H	A107
PL509	A37	PSR50	C12	QEL2/200	A108
PL519	A38	PSU60	C18	QEL2/275	A108
PL802	A38	PSU61	C18	QEL2/275H	A108
PL1607	A160	PWB63	C15	QQC03/14	A108
PL5544	A160	PY81	A38	QQC04/15	A108
PL5545	A160	PY82	A38	QQE02/5	A109
PL5555	A176	PY88	A39	QQE03/12	A109
PL5557	A161	PY500	A39	QQE03/20	A109
PL5559	A161	PY500A	A39	QQE03/32	A109
PL5632	A161	Q13-110 ..	A89	QQE04/5	A109
PL5684	A161	QB2/250	A104	QQE04/20	A109
PL5727	A161	QB3/200	A104	QQE06/40	A110
PL6574	A162	QB/300	A104	RA2A	C5
PL6755A	A162	QB3/300GA	A104	RA2B	C5
PM84	A38	QB3.5/750	A104	RD10	C7
PR1	C3	QB3.5/750GA	A104	RD11	C7
PR52	C182	QB4/1100	A105	RI-12	A195
PS2	C3	QB4/1100GA	A105	RI-20	A195
PS10	C7	QB5/1750	A105	RIC50	C11
PS90	C17	QB5/2000	A105	RM4	C358
PS1010	A182	QBL3.5/2000	A105	RM5	C360
PS1011	A182	QBL4/800	A105	RM6-R	C362
PS1012	A182	QBL5/3500	A105	RM6-S	C364
PS1013	A182	QBW5/3500	A106	RM8	C366
PS1014	A182	QC05/35	A106	RPY13	A133
PS1014SF	A182	QE03/10	A106	RPY18	A133
PS1520	A182	QE04/10	A106	RPY19	A133
PS1521	A182	QE05/40	A106	RPY20	A134
PS1531	A183	QE05/40F	A107	RPY27	A134
PS2010/50	A183	QE05/40H	A107	RPY33	A134
PS2010/100	A183	QE05/40K	A107	RPY41	A134
PS5302	A182	QE08/200	A107	RPY43	A134
PS5400	A184	QE08/200H	A107	PRY55	A134

TYPE NUMBER INDEX OF TUBES, SEMICONDUCTORS AND INTEGRATED CIRCUITS

PRY58	A134	TAA840	B254	TBL7/9000	A94
RPY71	A134	TAA960	B268	TBL12/25	A94
RPY76A	A137	TAA970	B246	TBL12/38	A94
RSA61	C16	TAB101	B267	TBL12/40	A94
RSR10	C9	TAD100	B254	TBL12/100	A94
S5600	A185	TAL12/10	A90	TBL15/125	A95
S5600/01	A185	TAL12/20	A90	TBW6/14	A95
S5600/02	A185	TAL12/35	A90	TBW6/6000	A95
S5600/03	A185	TAW12/10	A90	TBW7/8000	A95
SAM series	A181	TAW12/20	A91	TBW7/9000	A95
SG1	C5	TAW12/35G	A91	TBW12/25	A95
SID50	C12	TB2.5/300	A91	TBW12/38	A95
SIS series	A181	TB2.5/400	A91	TBW12/100	A95
SL109	A185	TB3/750	A91	TBW15/125	A95
SPF series	A181	TB4/1250	A91	TH71	A195
SPH series	A181	TB4/1500	A92	TH73	A195
SU50	C13	TB5/2500	A92	TH75	A195
TAA263	B244	TBA221	B252	TT60	C15
TAA293	B267	TBA222	B252	TT61	C16
TAA300	B244	TBA240	B259	TU10	C7
TAA310	B244	TBA281	B268	TU60	C15
TAA320	B244	TBH6/14	A92	TVHC40	A146
TAA350	B258	TBH6/6000	A92	UABC80	A39
TAA370	B248	TBH7/8000	A92	UAF42	A40
TAA435	B244	TBH7/9000	A92	UB41	A40
TAA450	B258	TBH12/25	A92	UBC41	A40
TAA521	B252	TBH12/38	A92	UBC81	A40
TAA522	B252	TBL2/300	A92	UBF80	A41
TAA550	B258	TBL2/400	A93	UBF89	A41
TAA560	B248	TBL2/500	A93	UCC85	A41
TAA570	B258	TBL6/14	A93	UCH21	A41
TAA580	B250	TBL6/20	A93	UCH42	A41
TAA630	B259	TBL6/4000	A93	UCH81	A42
TAA640	B268	TBL6/6000	A93	UCL82	A42
TAA700	B258	TBL7/8000	A94	UF41	A43

UF42	A43	XP1004	A138	XP1140	A141
UF80	A43	XP1005	A138	XP1141	A141
UF85	A43	XP1006	A138	XP1143	A141
UF89	A43	XP1010	A138	XP1180	A141
UL41	A44	XP1011	A138	XP1190	A184
UL84	A44	XP1015	A138	XP1191	A184
UM84	A44	XP1016	A138	XP1192	A184
UMC60	C15	XP1020	A138	XP1193	A184
UPA61	C16	XP1021	A138	XP1200	A184
UY41	A45	XP1023	A138	XP1210	A141
UY42	A45	XP1030	A139	XP1220	A141
UY82	A45	XP1031	A139	XP1230	A141
UY85	A45	XP1032	A139	XQ1010	A85
UY89	A45	XP1033	A139	XQ1020	A81
VSO	C20	XP1034	A139	XQ1020B	A81
WR0617	C184	XP1040	A139	XQ1020G	A81
WR0617E	C185	XP1041	A139	XQ1020L	A81
WR0825	C184	XP1050	A184	XQ1020R	A81
WR0825E	C185	XP1051	A184	XQ1021	A81
WR0842	C184	XP1052	A184	XQ1021B	A81
WR0842E	C185	XP1053	A184	XQ1021G	A81
WR0865	C184	XP1110	A139	XQ1021R	A81
WR0865E	C185	XP1113	A140	XQ1022	A81
X22	C370	XP1114	A140	XQ1023	A81
X30	C370	XP1115	A140	XQ1023L	A81
X35	C370	XP1116	A140	XQ1023R	A81
XA1000	A146	XP1117	A140	XQ1024	A82
XA1001	A146	XP1118	A140	XQ1024R	A82
XA1002	A146	XP1119	A140	XQ1025	A82
XA1003	A146	XP1120	A144	XQ1025L	A82
XL7900	A197	XP1121	A144	XQ1025R	A82
XP1000	A138	XP1122	A144	XQ1026	A82
XP1001	A138	XP1123	A144	XQ1026R	A82
XP1002	A138	XP1130	A144	XQ1031	A85
XP1003	A138	XP1131	A144	XQ1032	A85

TYPE NUMBER INDEX OF TUBES, SEMICONDUCTORS
AND INTEGRATED CIRCUITS

XQ1040	A85	XQ1240	A86	YD1332	A100
XQ1041	A85	XQ1241	A86	YD1333	A101
XQ1042	A85	YD1000	A95	YD1342	A101
XQ1043	A85	YD1001	A96	YD1343	A101
XQ1044	A85	YD1002	A96	YD1352S	A101
XQ1050	A86	YD1010	A96	YH1090	A128
XQ1051	A86	YD1012	A96	YH1170	A128
XQ1052	A86	YD1050	A130	YH1172	A128
XQ1053	A86	YD1120	A96	YH1210	A128
XQ1054	A86	YD1130	A96	YJ1000	A121
XQ1070	A82	YD1140	A97	YJ1010	A121
XQ1070/01	A82	YD1141	A97	YJ1011	A121
XQ1070B	A82	YD1150	A97	YJ1020	A121
XQ1070/01B	A82	YD1151	A97	YJ1021	A121
XQ1070G	A82	YD1152	A97	YJ1030	A121
XQ1070/01G	A82	YD1160	A97	YJ1040	A121
XQ1070L	A82	YD1161	A97	YJ1060	A122
XQ1070/01L	A82	YD1162	A98	YJ1071	A122
XQ1070R	A82	YD1170	A98	YJ1110	A122
XQ1070/01R	A82	YD1171	A98	YJ1120	A122
XQ1071	A83	YD1172	A98	YJ1121	A122
XQ1071/01	A83	YD1173	A98	YJ1140	A122
XQ1071B	A83	YD1180	A98	YJ1160	A125
XQ1071/01B	A83	YD1182	A99	YJ1162	A125
XQ1071G	A83	YD1190	A99	YJ1191	A125
XQ1071/01G	A83	YD1192	A99	YJ1200	A122
XQ1071R	A83	YD1193	A99	YJ1280	A125
XQ1071/01R	A83	YD1202	A99	YJ1290	A123
XQ1072	A83	YD1203	A99	YJ1300	A123
XQ1080 series	A83	YD1212	A99	YK1000	A126
XQ1090 series	A83	YD1213	A99	YK1001	A126
XQ1210 series	A83	YD1240	A100	YK1002	A126
XQ1213	A83	YD1300	A100	YK1004	A126
XQ1220 series	A84	YD1301	A100	YK1005	A126
XQ1230 series	A84	YD1330	A100	YK1010	A126

YK1090	A127	YL1290	A115	ZC1040	A165
YK1091	A127	YL1320	A116	ZC1050	A165
YK1110	A127	YL1330	A116	ZC1060	A165
YK1150	A127	YL1340	A116	ZM1000	A170
YL1000	A110	YL1341	A116	ZM1000R	A170
YL1010	A110	YL1360	A116	ZM1001	A170
YL1011	A110	YL1370	A116	ZM1001R	A170
YL1012	A110	YL1371	A117	ZM1002	A170
YL1020	A111	YL1372	A117	ZM1005	A170
YL1030	A111	YL1420	A117	ZM1005R	A170
YL1060	A111	YL1430	A117	ZM1020	A170
YL1070	A111	YL1440	A117	ZM1021	A170
YL1071	A111	YL1470	A117	ZM1022	A170
YL1080	A112	YL1520	A117	ZM1023	A171
YL1090	A112	YL3619	C64	ZM1024	A171
YL1091	A112	YL3620	C64	ZM1025	A171
YL1100	A112	YL3621	C64	ZM1030	A171
YL1101	A112	YL3622	C64	ZM1031/01	A171
YL1102	A113	YL3670	C64	ZM1032	A171
YL1103	A113	YL3672	C64	ZM1033/01	A171
YL1110	A113	YL3678	C64	ZM1040	A172
YL1120	A113	YL3680	C64	ZM1041	A172
YL1121	A113	YL3682	C64	ZM1042	A172
YL1130	A113	YL3687	C64	ZM1043	A172
YL1150	A113	YL3690	C64	ZM1050	A172
YL1170	A114	YL4200	C64	ZM1080	A172
YL1181	A114	Z70U	A164	ZM1081	A173
YL1182	A114	Z71U	A164	ZM1082	A173
YL1190	A114	Z504S	A175	ZM1083	A173
YL1200	A114	Z50SS	A175	ZM1162	A173
YL1210	A114	Z803U	A164	ZM1170	A173
YL1220	A115	Z900T	A164	ZM1172	A173
YL1230	A115	ZA1001	A164	ZM1174	A173
YL1240	A115	ZA1002	A165	ZM1175	A173
YL1250	A115	ZA1004	A165	ZM1176	A173

TYPE NUMBER INDEX OF TUBES, SEMICONDUCTORS
AND INTEGRATED CIRCUITS

ZM1177	A173	1N748A		2J55	A123
ZM1200	A174	to	B27	2K25	A127
ZM1202	A174	1N759A		2.LPA60	C15
ZM1204	A174	1N914	B12	2N174	B95
ZM1206	A174	1N914A	B12	2N277	B95
		1N914B	B12		
ZM1230	A174	1N916	B13	2N441	B95
ZM1232	A174	1N916A	B13	2N706A	B117
ZM1310	A174	1N916B	B13	2N708	B117
ZM1320	A174	1N4009	B13	2N709	B117
ZM1325	A175	1N4148	B13	2N743	B117
ZP1080	A178	1N4150	B13	2N744	B117
ZP1081	A178	1N4151	B14	2N753	B118
ZP1082	A178	1N4154	B14	2N914	B118
ZP1083	A178	1N4446	B14	2N929	B67
ZP1100	A178	1N4448	B14	2N930	B67
ZT1000	A153	1N5152	B18	2N1100	B95
ZT1001	A153	1N5153	B18	2N1131	B118
ZT1011	A162	1N5155	B18	2N1132	B118
ZX1051	A176	1N5157	B18	2N1302	B119
ZX1052	A176			2N1303	B119
		1N5729B			
ZX1053	A176	to	B28	2N1304	B119
ZX1060	A176	1N5757B		2N1305	B119
ZX1061	A176	2C39A	A130	2N1306	B120
ZX1062	A177	2C39BA	A130	2N1307	B120
ZX1063	A177	2DCA2	C3	2N1308	B120
ZY1000	A154	2.DCA11	C8	2N1309	B120
ZY1001	A154	2.DCA12	C9	2N1613	B84
ZY1002	A154	2.GI1	C2	2N1711	B84
ZZ1000	A168	2.GI10	C6	2N1893	B84
0A2	A167	2.GI11	C6	2N2218	B121
0A2WA	A167	2.GI12	C6	2N2218A	B121
0B2	A167	2.IA60	C14	2N2219	B121
0B2WA	A167	2.ID1	C4	2N2219A	B121
1MLU	C24	2J42	A123	2N2221	B121
		2J51A	A123	2N2221A	B122

2N2222	B122	2N3771	B96	4C35A	A163
2N222A	B122	2N3772	B96	4J50	A123
2N2297	B85	2N3823	B132	4J52A	A123
2N2368	B123	2N3866	B102	4.NOR51	C12
2N2369	B123	2N3924	B103	4.NOR60	C14
2N2369A	B123	2N3926	B103	4.TG15	C7
2N2475	B123	2N3927	B103	5C22	A163
2N2483	B85	2N3966	B132	5J26	A123
2N2484	B85	2N4036	B127	6AQ5	A46
2N2894	B124	2N4091	B133	6AT6	A46
2N2894A	B124	2N4092	B133	6AU6	A46
2N2904	B125	2N4093	B133	6AV6	A47
2N2904A	B125	2N4347	B96	6BA6	A47
2N2905	B125	2N4391	B133	6BE6	A47
2N2905A	B125	2N4392	B134	6F3	C38
2N2906	B125	2N4427	B103	6F8	C38
2N2906A	B126	2N4856	B134	6H2	C38
2N2907	B126	2N4857	B135	6H3	C38
2N2907A	B126	2N4858	B135	6H4	C38
2N3055	B95	2N4859	B135	6H5	C38
2N3133	B126	2N4860	B135	6H6	C38
2N3134	B127	2N4861	B135	6H9	C38
2N3303	B127	2.NOR60	C14	6J6	A47
2N3375	B102	2.NOR61	C16	6V2	C38
		2.PL2	C2	6X4	A48
2N3426	B127				
2N3442	B95	2.SF60	C15	12AT6	A48
2N3553	B102	2.SRA10	C9	12AU6	A48
2N3570	B85	2.SS1	C5	12AV6	A48
		2.TG13	C6	12AX7S	A62
2N3571	B85	2.TG14	C6	12BA6	A48
2N3572	B85				
2N3632	B102	2.TG90	C17	12BE6	A48
		2.2N1	C2	32P06	C47
		2.3N1	C2	35W4	A48
		3C45	A162	50C5	A49
		3.NOR50	C12	53AVP	A141

TYPE NUMBER INDEX OF TUBES, SEMICONDUCTORS
AND INTEGRATED CIRCUITS

53DVP	A141	150AVP	A143	1725A	A157
53UVP	A141	150B2	A169	1738	A157
54AVP	A142	150C1K	A169	1749A	A158
54DVP	A142	150CV	A148	1788	A158
54UVP	A142	150CVP	A143	1838	A158
56AVP	A142	150TV	A148	1849	A158
56AVP/03	A142	150UV	A148	1859	A158
56AVP/05	A142	150UVP	A143	1904	A193
56CVP	A142	153AVP	A143	1905	A193
56DUVP	A142	155UG	A148	1908	A193
56DUVP/03	A142	328	A154	1909	A193
56DVP	A142	329	A193	1910	A193
56DVP/03	A142	340	A193	1927	A193
56SBUVP	A142	354	A155	1928	A193
56TUV P	A142	367	A155	1941A	A193
56TVP	A142	451	A155	4065	A194
56UVP	A142	500G2	C47	4066	A194
57AVP	A142	723A/B	A127	4068	A194
58AVP	A143	725A	A123	4069	A194
58DVP	A143	1010	A155	4152/02	A197
58UVP	A143	1037	A155	4349	A192
60AVP	A143	1039	A155	4369	A192
60SA	C34	1049	A155	4370	A102
60SR	C34	1054	A155	4371	A192
61SV	A137	1069K	A156	4372	A192
75C1	A168	1110	A156	4378	A192
83A1	A168	1119	A156	4379	A192
85A2	A168	1138	A156	4383	A192
90AV	A147	1163	A156	4390	A192
90C1	A169	1164	A156	4397	A192
90CG	A147	1173	A157	4662	A175
90CV	A147	1174	A157	4699	A49
92AG	A147	1176	A157	5586	A124
92AV	A147	1177	A157	5636	A62
150AV	A147	1710	A157	5639	A63

5642	A63	7093	A124	18555	A180
5643	A163	7289	A131	18600R	A186
5654	A63	7537	A128	18601	A186
5672	A63	7586	A197	18602	A186
5678	A63	7609	A118	18603	A186
5696	A163	7895	A197	40809	B142
5718	A64	7984	A118	40819	B143
5719	A64	8020	A198	40820	B143
5725	A64	8108	A131	40822	B144
5726	A64	8621	A118	40829	B144
5751	A65	9710M/01	C249	55029	
5814A	A65	18042	A67	to	A124
5823	A164	18045	A67	55032	
5840	A65	18503	A178	55335	A127
5842	A65	18504	A178	55340	A128
5876	A131	18505	A178	55875	A84
5876A	A131	18506	A178	55875B	A84
5893	A131	18507	A178	55875G	A84
5899	A65	18509	A179	55875L	A84
5902	A66	18511	A179	55875R	A84
5949	A163	18515	A179	55875-IG	A84
6021	A66	18516	A179	55875B-IG	A84
6080	A66	18517	A179	55875G-IG	A84
6111	A66	18518	A179	55875R-IG	A84
6112	A67	18520	A179	55876/01	A84
6189	A67	18522	A179	56032	A128
6201	A67	18526	A179	56050-1	A191
6263	A131	18527	A179	56054	A191
6263A	A131	18529	A179	56055	A191
6264	A131	18536	A179	56056	A191
6264A	A131	18545	A179	56057	A191
6293	A118	18546	A180	95108	A198
6972	A124	18550	A180		
7028	A124	18552	A180		
7090	A125	18553	A180		

TYPE NUMBER INDEX OF TUBES, SEMICONDUCTORS AND INTEGRATED CIRCUITS

2222 015 C129	2222 436 C126	2222 802 20014 C159
016 C129	437 C126	802 20015 C159
017 C129	438 C126	802 960.. C161
040 1.... C134	552 0.... C108	802 96035 C159
040 4.... C134	555 5.... C102	802 96036 C159
2222 063 C136	2222 561 0.... C108	2222 805 00... C162
063 900.. C141	562 01... C110	805 02... C162
064 C136	563 0.... C109	808 C167
067 900.. C141	565 0.... C109	809 050.. C170
071 1.... C142	625 56... C103	809 070.. C170
2222 072 1.... C142	2222 627 14... C110	2222 809 080.. C171
073 1.... C142	629 C104	2322 000 C190
080 C136	630 C104	003 C191
081 C136	631 C97	010 C191
101 1.... C145	632 C97	011 C192
2222 101 4.... C145	2222 638 C97	2322 012 C193
106 1.... C147	641 C97	013 C193
107 1.... C147	642 C97	095 C194
121 1.... C149	643 C97	096 C194
143 1.... C152	650 C100	097 C194
2222 146 1.... C154	2222 655 0.... C107	2322 120 2.... C183
311 31... C121	675 0.... C108	260 C184
311 51... C121	700 0.... C111	261 C184
325 C114	702 0.... C111	262 C184
326 C114	801 200.. C157	263 C184
2222 327 C114	2222 801 96002 C158	2322 264 C184
341 C117	801 96003 C158	321 C187
342 C115	802 20001 C158	322 C187
344 C119	802 20002 C158	323 C187
347 C122	802 20003 C158	324 C187
2222 424 C124	2222 802 20004 C158	2322 327 61... C183
425 C124	802 20005 C158	410 C202
426 C124	802 20011 C159	411 C203
427 C124	802 20012 C159	412 C204
435 C126	802 20013 C159	413 C204

2322 440 000.. C207	2322 643 11... C221	3112 348 20420 C242
450 C207	644 C213	3122 104 90490 C332
460 C208	644 11... C221	104 90514 C328
552 0.... C227	660 9100. C222	104 90620 C330
553 0.... C228	661 9100. C223	104 90680 C330
2322 554 0.... C229	2322 662 91001 C224	3122 104 92180 C327
555 0.... C230	662 93036 C224	104 92690 C332
564 C231	662 93066 C224	104 93210 C333
564 92003 C232	672 920.. C225	104 93530 C332
565 9000. C233	2422 529 0000. C77	104 93770 C332
2322 574 90001 C233	2422 530 C69	3122 104 93780 C331
574 90002 C233	535 0.... C337	104 93840 C327
575 C234	540 C243	104 94090 C331
576 C234	2722 043 C39	104 94330 C331
577 C234	045 C40	104 94490 C331
2322 600 93001 C237	2722 051 C41	3122 104 94601 C331
600 94001 C237	061 C42	104 94790 C327
600 95001 C237	062 C43	104 99170 C328
610 C211	131 0.... C52	107 52200 C328
611 C212	132 C52	108 12160 C328
2322 619 C213	2722 133 0.... C55	3122 127 10260 C261
622 C213	135 0.... C58	127 10450 C261
627 C214	151 000.. C18	4311 027 82... C25
627 3.... C215	161 01... C68	027 84... C28
628 C216	161 02... C66	4322 000 010.. C18
3222 634 C214	2722 161 03... C67	4322 020 35070 C327
635 01... C217	162 01... C65	020 69520 C333
636 01... C217	162 02... C67	026 C93
637 01... C217	3103 209 12030 C335	026 3.... C94
640 90001 C217	209 12040 C335	026 38... C92
2322 640 90002 C218	3103 224 90090 C335	4322 043 0.... C144
640 90003 C218	224 90100 C335	043 042.. C147
642 1.... C220	3104 101 80400 C335	152 C60
642 11... C219	3112 348 20070 C242	153 C60
642 21... C220	348 20240 C242	154 C60

TYPE NUMBER INDEX OF TUBES, SEMICONDUCTORS AND INTEGRATED CIRCUITS

4322	155	.....	C60
	157	.....	C60
	158	.....	C60
	159	0....	C60
	160	.....	C60
4322	163	.....	C60
	164	.....	C60
	165	.....	C60
	166	.....	C60
9904	110	.....	C298
9904	111	.....	C300
	112	.....	C306
	115	C302
	120	C313
	121	000..	C318
9904	121	00011	C317
	131	02001	C304
	131	02002	C304

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Another group of publications is **Product Surveys** which may be regarded as specialized catalogues on various products or groups of products.

Requests for any of these publications should be addressed to the organisation concerned. A list of addresses is given in this section.

POCKETBOOK

1972

electron tubes
semiconductors
integrated circuits
components
materials

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EINDHOVEN - The Netherlands

January 1972

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PREFACE

The 1972 edition of the Pocketbook is a completely revised version of the preceding one, containing brief data on the majority of the products of the Electronic Components and Materials Division of NV Philips' Gloeilampenfabrieken.

Unless otherwise specified all dimensions are given in mm. The European projection method is employed in the dimensional drawings.

The Pocketbook does not give information on availability or terms of delivery, and is subject to change without notice. Please regard it as a guide only and, for a comprehensive source of information on electronic components and materials, refer to our Data Handbook system, made up of three series of handbooks, which will be issued annually.

The three series, identified by the colours noted, each comprise the following parts:

ELECTRON TUBES (blue)

	<i>latest issue</i>
Part 1 Transmitting tubes for communication (pentodes, tetrodes)/Amplifier circuit assemblies	Jan. 1972
Part 2 Tubes for microwave equipment	Feb. 1972
Part 3 Special quality tubes/Miscellaneous devices	Mar. 1972
Part 4 Receiving tubes	Apr. 1971
Part 5 Cathode ray tubes/Associated accessories/Camera tubes/Photo tubes	May 1971
Part 6 Photomultiplier tubes/Channel electron multipliers Devices for nuclear equipment/Photo diodes/Associated accessories	June 1971
Part 7 Voltage stabilizing and reference tubes/Counter, selector and indicator tubes/Trigger tubes and switching diodes/Thyratrons/Industrial rectifying tubes/Ignitrons/High voltage rectifying tubes/Miscellaneous/Associated accessories	July 1971
Part 8 T.V. picture tubes	Aug. 1971
Part 9 Transmitting tubes for communication/Tubes for r.f. heating (triodes)/Associated accessories	Dec. 1971

SEMICONDUCTORS AND INTEGRATED CIRCUITS (red)

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Part 1 Signal diodes/Variable capacitance diodes/Voltage regulator diodes/Rectifier diodes/Thyristors, diacs, tracs/Rectifier stacks/Accessories/Heatsinks Sep. 1971

Part 2 Low frequency transistors/Low frequency power transistors/Deflection transistors/Accessories Oct. 1971

Part 3 High frequency transistors/Switching transistors/Accessories Nov. 1971

Part 4 Transmitting transistors/Microwave devices/Field effect transistors/Dual transistors/Microminiature devices for thick- and thin film circuits/Photoconductive devices/Photodiodes/Phototransistors/Light emitting diodes/Infra-red sensitive devices/Accessories Dec. 1971

Part 5 Linear integrated circuits Feb. 1972

Part 6 Digital integrated circuits/DTL-FC family/DTL; HNIL-FZ family/TTL-FJ family/TTL-GJ family/CML-GH family/MOS-FD family Mar. 1972

COMPONENTS AND MATERIALS (green)

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Part 1 Circuit blocks 40-Series/Counter modules 50-Series/
Norbits 60-Series, 61-Series/Circuit blocks 90-Series/Input-out-
put devices/Electro-mechanical components/Peripheral devices Oct. 1971

Part 2 Fixed resistors/Variable resistors/Non-linear resistors/
Ceramic capacitors/Polyester, polycarbonate, polystyrene,
paper capacitors/Electrolytic capacitors/Variable capacitors Dec. 1971

Part 3 FM tuners/Coils/Piezoelectric ceramic resonators and
filters/Loudspeakers/Audio and mains transformers/Television
tuners/Components for black and white television/Components
for colour television/Deflection assemblies for camera tubes Feb. 1972

Part 4 Ferrites for radio, audio and television/Small coils,
assemblies and assembling parts/Ferroxcube potcores and
square cores/Ferroxcube transformer cores/Piezoxide/
Permanent magnet materials Apr. 1971

Part 5 Memory products/Magnetic heads/Quartz crystal
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motors/Tachogenerators and servomotors/Asynchronous
motors/Indicators for built-in test equipment/Time indicators,
timers, timing motors Aug. 1971

Part 7 Circuit blocks 100 kHz-Series/Circuit blocks 1-Series/
Circuit blocks for ferrite core memory drive/Circuit blocks
10-Series Sep. 1971

The above subdivision of our Data Handbook system is valid at the date of issue of this Pocketbook; minor changes may be introduced before next issue,

CONTENTS

Preface	1
Contents	5
Type designation codes and symbols for electron tubes	11
General operational recommendations receiving tubes	27
Introduction replacement guide for electron tubes.	30
Type designation codes, rating systems and letter symbols for semi-conductors and integrated circuits	31
Introduction replacement guide for semiconductors and integrated circuits	60
ELECTRON TUBES.	A1
Receiving and amplifying tubes	A2
Special quality tubes	A50
Cathode-ray tubes	A68
T.V. picture tubes	A68
Instrument tubes	A73
Camera tubes "Plumbicons".	A81
Camera tubes "Vidicons"	A85
Monitor tubes	A87
Flying spot scanners and projection tubes	A89
Transmitting tubes	A90
Triodes	A90
Tetrodes, Pentodes	A103
Microwave tubes.	A120
Pulsed magnetrons	A120
Continuous-wave magnetrons	A125

Klystrons	A126
Travelling-wave tubes.	A128
Dual T.R. switch.	A128
Diodes and Triodes.	A129
Photosensitive devices	A132
Photoconductive cells.	A132
Photo diodes and transistors.	A135
Infra-red devices	A137
Photomultipliers	A138
Windowless photomultipliers	A144
Photo tubes	A146
Channel electron multipliers	A149
Gasfilled tubes.	A150
High voltage rectifiers	A150
Low voltage rectifiers.	A154
Thyratrons	A159
Trigger tubes and switching diodes	A164
Stabilizing and reference tubes	A167
Indicating tubes	A170
Counter and selector tubes	A175
Ignitrons	A176
Nuclear devices	A178
Radiation counter tubes.	A178
Scintillators	A181
Photoscintillators	A182
Neutron generators.	A186
Semiconductor radiation detectors	A187
Cryostats	A191
Miscellaneous	A192
Rare gas cartridges	A192
Current regulators	A193

Electrometer tubes	A194
Thermocouples	A195
Dry reed switches	A195
Remaining various tubes	A196
Replacement guide electron tubes.	A199

SEMICONDUCTORS AND INTEGRATED CIRCUITS B1

Diodes	B2
Low power diodes	B2
Variable capacitance diodes	B15
Zener diodes	B19
Rectifier diodes	B29
Thyristors.	B36
Rectifier stacks	B46
Transistors	B50
Low frequency transistors	B50
High frequency transistors.	B69
Power transistors.	B86
Transmitter transistors	B97
Deflection transistors	B104
Switching transistors	B105
Field effect transistors	B128
Microminiature devices for thick- and thin-film circuits	B136
Miscellaneous transistors	B140
Integrated circuits	B145
Digital monolithic integrated circuits	B146
Linear monolithic integrated circuits	B244
Replacement guide transistors	B272
Replacement guide small signal diodes	B287
Replacement guide voltage regulator (zener) diodes	B292
Replacement guide integrated circuits	B302

COMPONENTS AND MATERIALS	C1
Data processing and control	C2
Circuit blocks	C2
Accessories for circuit blocks	C18
Input/output devices	C20
Miscellaneous components	C30
Power stacks with diodes and/or thyristors.	C30
Peripheral devices	C34
Memory products	C38
Magnetic heads	C52
Quartz crystal units and crystal filters	C60
Microwave devices	C65
Variable mains transformers	C69
Electro-mechanical components	C78
Capacitors	C96
Ceramic capacitors	C96
Metallised polyester capacitors	C113
Foil on film polyester capacitors	C121
Polystyrene capacitors	C124
Electrolytic capacitors	C129
Variable capacitors	C157
Resistors	C172
Fixed resistors	C172
Variable resistors.	C190
NTC thermistors.	C210
PTC thermistors	C222
Voltage dependent resistors	C225
Light dependent resistors	C236
Standard series of values in a decade	C238
Radio and audio components	C240
F.M. tuners	C240

Coils for transistorised radio receivers	C242
Piezoelectric ceramic resonators and filters	C243
Loudspeakers	C244
Television components	C252
Television tuners	C252
Coaxial aerial input assemblies	C261
Deflection components for black and white television	C262
Components for colour television	C266
Deflection assemblies for camera tubes	C291
Motors	C298
Synchronous motors	C298
Universal programme switch assembly kit (UPAK)	C304
Stepper motors	C306
Direct current motors	C313
Tachogenerators and servomotors	C317
Materials	C319
Manganese zinc and nickel zinc ferrites	C319
Ferrites for radio, audio and television	C321
Microchokes	C336
Pre-adjusted ferroxcube potcores, P-Series	C338
Pre-adjusted ferroxcube square cores	C358
Transformer cores	C368
Piezoxide	C376
Permanent magnet materials	C384
Typenumber index of tubes, semiconductors, integrated circuits, components and materials	D1

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